Series 3730
Type 3730-5 Electropneumatic Positioner

SAMSON

with FOUNDATION™ fieldbus communication

FF device rev. 1



Fig. 1 · Type 3730-5

FOUNDATION

Mounting and Operating Instructions

EB 8384-5 EN (1300-1614)

Firmware version **K 1.26/ R 1.46**

Edition December 2013

CE Ex certified

Definitions of the signal words used in these instructions

⚠ ***DANGER!***
indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING!
indicates a hazardous situation which, if not avoided, could result in death or serious injury.

NOTICE
indicates a property damage message.

Note: *Supplementary explanations, information and tips*

Contents | Page

Modifications of positioner firmware in comparison to previous versions	
Previous	New
Communication K 1.11	**K 1.21**
Leakage sensor at binary input 2	The connection of a leakage sensor at binary input 2 (by selecting LEAKAGE SENSOR in CONFIG_BINARY_INPUT2 parameter of the AO Transducer Block) causes: ▸ Information specified in XD_ERROR_EXT parameter in the AO Transducer Block and the generation of a diagnostic alarm which is logged ▸ The state of the binary input is reported in BINARY_INPUT2 parameter in the AO Transducer Block
Diagnostic alarm "Device not initialized"	The diagnostic alarm "Device not initialized" is generated when the positioner is not initialized and the condensed status is set to "Maintenance alarm".
Display of the operating range FINAL_VALUE_RANGE	The correction of the operating range FINAL_VALUE_RANGE over on-site operation of the positioner (Code 8/9) is also transferred over fieldbus in firmware version K 1.21 and higher.
Inactivated internal solenoid valve	A masking allows to be set whether an inactivated internal solenoid valve generates an AO block error and a resulting block alarm.
SOLENOID_SELECT parameter	The SOLENOID_SELECT parameter in firmware K 1.21 and higher allows to be set whether a "Maintenance now" block error of the AO Transducer Block results in an output error in the AO Block.
TOT_VALVE_TRAV_LIM parameter	New range: 1000 … 990 000 000
	K 1.22
Operating range FINAL_VALUE_RANGE	The operating range FINAL_VALUE_RANGE of the AO Transducer Block is compared on entering it with TRANSM_PIN_POS. If the TRANSM_PIN_POS parameter is changed, the positioner checks whether the setting and unit match the current operating range FINAL_VALUE_RANGE. If this is not the case, the FINAL_VALUE_RANGE parameter is set to 0 to 100 %.
VALVE_TYPE parameter	The parameter of the AO Transducer Block is set depending on the selected PIN_POS. The last setting is kept when VALVE_TYPE is set to OFF.
FINAL_VALUE parameter	The manipulated variable is scaled with FINAL_VALUE_ RANGE in firmware K 1.22 and higher, and not with XD_SCALE.
Display of O/S mode in AO Transducer Block	If the AO Transducer Block is set to O/S mode, this is indicated in the positioner display by MAN/AUTO.

Modifications of positioner firmware in comparison to previous versions	
Previous	New
	K 1.23
	Internal modifications
	K 1.24
BUS_ADDRESS parameter	The bus address has the default setting of 248.
Device type	In the delivery state, the device is configured as a basic device.
	K 1.25
	Internal modifications
	K 1.26
	Corrections in PID Function Block allow a bumpless transfer from manual to automatic mode. The revisions affect the 'Direct action' option in the PID Function Block. Refer to CONTROL_OPTS parameter.
Control R 1.43	**R 1.44**
	Internal modifications
	R 1.45
	Internal modifications
	R 1.46
	Internal modifications

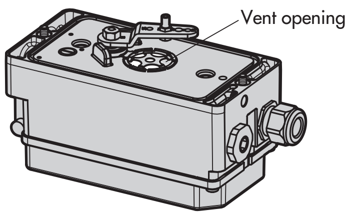
1 Important safety instructions

For your own safety, follow these instructions concerning the mounting, start-up and operation of the positioner:

- The positioner is to be mounted, started up or operated only by trained and experienced personnel familiar with the product.
  According to these Mounting and Operating Instructions, trained personnel refers to individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.
- Explosion-protected versions of this positioner may only be operated by personnel who have undergone special training or instructions or who are authorized to work on explosion-protected devices in hazardous areas. Refer to section 13.
- Any hazards that could be caused by the process medium, the operating pressure, the signal pressure or by moving parts of the control valve are to be prevented by means of the appropriate measures.
- If inadmissible motions or forces are produced in the actuator as a result of the supply pressure, the supply pressure must be restricted by means of a suitable supply pressure reducing station.

To avoid damage to any equipment, the following also applies:

- Do not operate the positioner with the back of the positioner/vent opening facing upwards.
  The vent opening must not be sealed when the positioner is installed on site.



- Proper shipping and appropriate storage are assumed.
- Do not ground electric welding equipment near to the positioner.

Note: *The device with a CE marking fulfills the requirements of the Directives 94/9/EC (ATEX) and 89/336/EEC (EMC).*
The Declaration of Conformity is available on request.

2 Article code

Positioner	**Type 3730-5**	x	x	x	0	x	0	x	x	0	x	0	0	x	0	x	x
With LCD and autotune, FOUNDATION™ fieldbus																	
Explosion protection																	
Without		0															
ATEX: II 2G Ex ia IIC T6; II 2D Ex tb IIIC T80°C IP66		1															
FM/CSA: Class I, Zone 0 AEx ia IIC; Class I, II, III, Div.1, Groups A–G; Class I, Div.2, Groups A–D; Class II, Div.2, Groups F, G/ Ex ia IIC T6; Class I , II, Div.1, Groups A–G; Ex nA II T6; Ex nL IIC T6; Class I, II, Div.2, Groups A–G; Class II, Div.1, Groups E, F, D		3															
ATEX: II 3G Ex nA II T6; II 3G Ex ic IIC T6; II 3D Ex tc IIIC T80°C IP66		8															
Additional equipment																	
Inductive limit switch	Without		0														
	SJ2-SN (NC contact)		1														
	SJ2-S1N (NO contact)		2														
Solenoid valve	Without			0													
	mit, 24 V DC			4													
External position sensor	Without					0											
	With		0			1		0			0						
Binary input	Without							0									
	Floating contact					0											
Diagnostics																	
EXPERT (standard)									1								
EXPERT+ (extended diagnositics)									2								
Housing material																	
Aluminum (standard)											0						
Stainless steel 1.4581						0					1						
Special applications																	
None														0			
Positioner compatible with paint														1			
Vent connection with ¼-18 NPT thread, back of housing sealed			0	0		0		0						2			
Special version																	
None															0	0	0
NEPSI: Ex ia IIC T6		1													0	0	9
NEPSI: Ex nA II T6; Ex nL IIC T6		8													0	1	0
IECEx: Ex ia IIC T6		1													0	1	2
GOST: 1Ex ia IIC T6		1													0	1	4

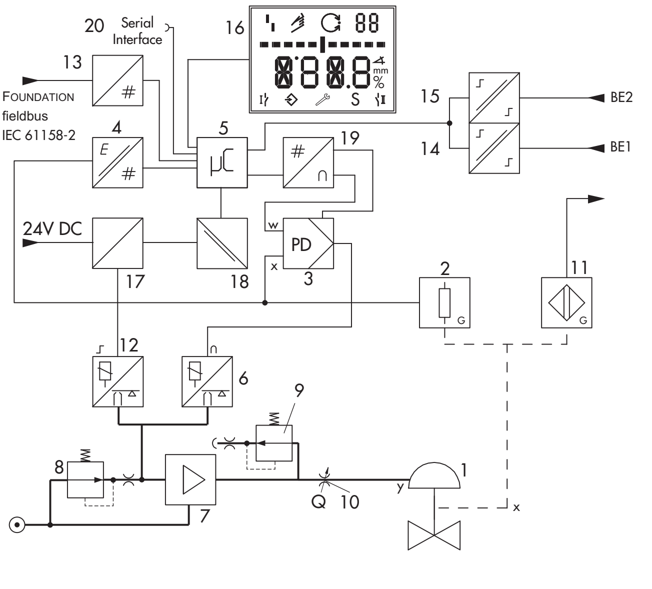
3 Design and principle of operation

The electropneumatic positioner is attached to pneumatic control valves. It is used to assign the valve stem position (controlled variable x) to the control signal (reference variable w). The input signal received from a control system is compared to the travel or rotational angle of the control valve, and a pneumatic signal pressure (output variable y) is produced.

The positioner consists of a travel sensor system proportional to resistance, an analog i/p converter with a downstream booster and the electronics unit with microcontroller.

When a deviation occurs, the actuator is pressurized or vented. If required, the changes in the signal pressure can be slowed down by a connectable Q restriction. The signal pressure supplied to the actuator can be limited by software or on site to 1.4, 2.4 or 3.7 bar.

A constant air stream to the atmosphere is created by the flow regulator (9) with a fixed set point. The air stream is used to purge the inside of the case as well as to optimize the air capacity booster. The i/p module (6) is supplied with a constant upstream pressure by the pressure regulator (8) to make it independent of the supply air pressure.



1 Control valve
2 Travel sensor
3 PD controller
4 A/D converter
5 Microcontroller
6 i/p converter
7 Air capacity booster
8 Pressure regulator
9 Flow regulator
10 Volume restriction
11* Inductive limit switch
12* Solenoid valve
13 IEC 61158-2 interface module
14 Binary input, passive
15* Binary input, active
16 Display
17* Solenoid valve control
18* Galvanic isolation
19 D/A converter
20 Communication interface

* Optional

Fig. 2 · Functional diagram

The positioner communicates and is powered using IEC 61158-2 transmission technology conforming to FOUNDATION™ fieldbus specification.

As a standard feature, the positioner comes with a binary input for DC voltage signals to signalize process information over the FOUNDATION™ fieldbus.

3.1 Additional equipment

Version with solenoid valve

If the operating voltage for the solenoid valve (12) fails, the supply pressure for the i/p module is vented to the atmosphere. The positioner can no longer operate and the control valve moves to the fail-safe position determined by the actuator, independent of the reference variable.

NOTICE
In manual mode (MAN), the manual set point is also reset to 0 %. A different manual set point must be entered again (Code 1).

Version with inductive limit switch

The rotary shaft of the positioner carries an adjustable tag which actuates the installed proximity switch.

Version with binary contact

All positioners are fitted with a binary input for DC voltage signals over which process information can be issued over the FOUNDATION™ fieldbus network.
Another optional binary input is an active input powered by the positioner to connect a floating contact. Its switching condition can also be issued over the FOUNDATION™ fieldbus network.

Version with external position sensor

In this version, only the sensor is mounted to the control valve. The positioner is located separately from the valve.
The connection of x and y signals to the valve is established by cable and piping for air (only without inductive limit switch).

EXPERT+ extended valve diagnostics

See Table 5 on page 42 for order numbers.

EXPERT+ upgrades the standard EXPERT diagnostics firmware incorporated in the positioner. The upgraded version provides extended functions to pinpoint valve parameters that have worsened, allowing the user to plan predictive maintenance and service work before malfunctions can affect the process and may cause unscheduled plant shutdowns.

The extended EXPERT+ diagnostics can be activated later at the positioner when EXPERT+ is not already activated on delivery of the positioner. The required activation code or an EXPERT+ USB dongle can be purchased to activate EXPERT+.

3.2 Communication

The positioner is completely controlled over the digital signal transmission implemented according to FOUNDATION™ fieldbus specification.

Data are transmitted as bit-synchronous current modulation at a rate of 31.25 kbit/s

over twisted-pair cables conforming to IEC 61158-2.

Note: *In the case, complex functions are started in the positioner, which require a long calculation time or lead to a large quantity of data being stored in the volatile memory of the positioner, the alert "busy" is issued over DD.*
*This alert is **not a fault alarm** and can simply be confirmed.*

Configuration using TROVIS-VIEW software

The positioner can be configured using TROVIS-VIEW Configuration and Operator Interface software.
The positioner is equipped with an additional digital **SERIAL INTERFACE** to connect the RS-232 or USB port of the computer to the positioner over an adapter cable.
The TROVIS-VIEW software enables the user to easily set parameters in the positioner and view process parameters online.

Note: *The TROVIS-VIEW software is a common operator interface for various smart SAMSON devices. The software together with a device-specific module allow the configuration and parameterization of the device.*
The device-specific module for Type 3730-5 can be downloaded free of charge from the SAMSON website (Services > Software > TROVIS-VIEW).
Additional information on TROVIS-VIEW (e.g. system requirements) can found on the SAMSON website and in the Data Sheet T 6661 EN.

Configuration using the NI-FBUS™ Configurator

The NI-FBUS™ Configurator from National Instruments can also be used to configure the positioner. For this purpose, an interface card must be installed in a computer to connect it to the FOUNDATION™ fieldbus.
The integrated function blocks are linked using the NI-FBUS™ Configurator.

3.3 Technical data

Type 3730-5 Positioner (technical data in test certificates additionally apply for explosion-protected devices)		
Rated travel, adjustable		Direct attachment to Type 3277: 3.6 to 30 mm Attachment acc. to IEC 60534-6: 3.6 to 200 mm Attachment to rotary actuators (VDI/VDE 3845): 24° to 100°
Travel range, adjustable		Adjustable within the initialized travel/angle of rotation; travel can be restricted to 1/5 at the maximum
Bus connection		Fieldbus interface acc. to IEC 61158-2 bus-powered Physical Layer Class: 113 (without explosion protection) und 111 (with ex. protection) Field device acc. to FM 3610 Entity, FISCO and FNICO
Communi-cation	Fieldbus	Data transmission as per FOUNDATION™ fieldbus specification, Communication Profile Class: 31 PS, 32 L; Interoperability tested according to Interoperability Test System (ITK) Revision 4.6
	Execution times	PID FB: 20 ms DI FB: 20 ms MAI FB: 50 ms IS FB: 30 ms AO FB: 30 ms DO FB: 30 ms MAO FB: 50 ms
	Local	Over SAMSON SSP interface and serial interface adapter Software requirements: SAMSON TROVIS-VIEW with database module 3730-5
Permissible operating voltage		9 to 32 V DC, power supply over bus line The limits in test certificate additionally apply for explosion-protected devices.
Max. operating current		15 mA
Add. current in case of fault		0 mA
Supply air		Supply pressure from 1.4 to 7 bar (20 to 105 psi)
	Air quality ISO 8573-1 (2001=	Max. particle size and density: Class 4 Oil content: Class 3; Moisture and water: Class 3; Pressure dew point: At least 10 K beneath the lowest ambient temperature to be expected
Signal pressure (output)		0 bar up to supply pressure, limitable to 1.4/2.4/3.7 bar ±0.2 bar via software
Characteristic		Linear/equal percentage/reverse equal percentage · User-defined (over operating software and communication) · Butterfly valve linear/equal percentage · Rotary plug valve linear/equal percentage · Segmented ball valve linear/equal percentage Deviation from terminal-based conformity ≤ 1 %
Hysteresis		≤ 0.3 %
Sensitivity		≤ 0.1 %
Direction of action		Reversible
Air consumption		Independent from supply pressure approx. 110 l_n/h
Air output capacity	Actuator filled with air	At Δp = 6 bar: 8.5 m_n^3/h, at Δp = 1.4 bar: 3.0 m_n^3/h $K_{Vmax\,(20\,°C)}$ = 0.09
	Actuator vented	At Δp = 6 bar: 14.0 m_n^3/h, at Δp = 1.4 bar: 4.5 m_n^3/h $K_{Vmax\,(20\,°C)}$ = 0.15

Type 3730-5 Positioner (technical data in test certificates additionally apply for explosion-protected devices)		
Permissible ambient temperature		–20 to +80 °C for all versions –45 to +80 °C with metal cable gland –25 to +80 °C with inductive limit switch (SJ2-S1N) and metal cable gland The limits in test certificate additionally apply for explosion-protected devices.
Influences	Temperature	≤ 0.15 %/10 K
	Supply air	None
	Vibration	≤ 0.25 % up to 2000 Hz and 4 g acc. to IEC 770
Electromagnetic compatibility		Complying with EN 61000-6-2, EN 61000-6-3, EN 61326-1 and NAMUR Recommendation NE 21
Explosion protection	ATEX Type 3730-51 Type 3730-58	II 2G Ex ia IIC T6; II 2D Ex tb IIIC T80°C IP66 II 3G Ex nA II T6; II 3G Ex ic IIC T6; II 3D Ex tc IIIC T80°C IP66
	CSA Type 3730-53	Ex ia IIC T6; Class I , II, Div.1, Groups A, B, C, D, E, F, G; Ex nA II T6; Ex nL IIC T6; Class I, II, Div.2, Groups A, B, C, D, E, F, G; Class II, Div.1, Groups E, F, D
	FM Type 3730-53	Class I, Zone 0 AEx ia IIC; Class I, II, III, Div.1, Groups A, B, C, D, E, F, G; Class I, Div.2, Groups A, B, C, D; Class II, Div.2, Groups F, G
	GOST Type 3730-51	1Ex ia IIC T6
	IECEx Type 3730-51	Ex ia IIC T6
	KCS Type 3730-5	Ex ia IIC T6/T5/T4
	NEPSI Type 3730-51 Type 3730-58	Ex ia IIC T6 Ex nA II T6, Ex nL IIC T6
	STCC Type 3730-5	0Ex ia IIC T6X, 2Ex s II T6 X
	CCoE, INMETRO	On request
Electrical connection		One M20 x 1.5 cable gland, for 6 to 12 mm clamping range Second additional threaded M20 x 1.5 hole Screw terminals for 0.2 to 2.5 mm^2 wire cross-section
Degree of protection		IP 66/NEMA 4X
Implementation in safety-related systems in compliance with IEC 61508/SIL		Probability of failure on demand of safety functions PFD < 2.8 x 10^{-7} for a confidence level of 95 %. The safe failure fraction (SFF) according to Table A1 in IEC 61508-2 is greater or equal to 0.99. The valves are therefore suitable for implementation in safety-related systems with a hardware fault tolerance of 1 or 2 up to and including SIL 4.
Binary contact 1		
Input		0 to 30 V DC reverse polarity protection, static destruction limit 40 V, current consumption 3.5 mA at 24 V, galvanically isolated
Signal		Signal "1" at Ue > 5 V · Signal "0" at Ue < 3 V

Materials	
Housing	Die-cast aluminum EN AC-AlSi12(Fe) (EN AC-44300) acc. to DIN EN 1706; chromated and powder paint coated · Special version: stainless steel 1.4581
External parts	Stainless steel 1.4571 and 1.4301
Cable gland	Nickel-plated brass, M20x1.5
Weight	Approx. 1 kg
Options for Type 3730-5	
Binary contact 2 for floating contact	
Switching input	R < 100 Ω, contact loadability 100 mA, static destruction limit 20 V/5.8 mA, galvanically isolated
Solenoid valve	Approval acc. to IEC 61508/SIL
Input	24 V DC, reverse polarity protection, static destruction limit 40 V Current consumption $I = \frac{U - 5.7\ V}{3840\ \Omega}$ (corresponding to 4.8 mA at 24 V/114 mW)
Signal "0" no pick-up	≤ 12 V
Signal "1" safe pick-up	>19 V
Service life	>5 x 10^6 switching cycles
K_V coefficient	0.15
Implementation in safety-related systems in compliance with IEC 61508/SIL	Same as positioner pneumatics
Inductive limit switch	For connection to switching amplifier acc. to EN 60947-5-6
SJ2-SN proximity switch	NAMUR NC contact
SJ2-S1N proximity switch	NAMUR NO contact
External position sensor	
Travel	Same as positioner
Cable	10 m with M12x1 connector, designed for continuous flexing, flame retardant acc. to VDE 0472, resistant to oils, lubricants, coolants as well as other corrosive media
Perm. ambient temperature	–60 to +105 °C
Vibration immunity	Up to 10 g in the range between 10 and 2000 Hz
Degree of protection	IP 67

4 Attachment to the control valve – Mounting parts and accessories

WARNING!
Mount the positioner, keeping the following sequence:
1. Remove protective film from pneumatic connections.
2. Mount the positioner on the control valve
3. Connect the supply air
4. Connect the electrical power
5. Perform the start-up settings

The positioner is suitable for the following types of attachment:

- Direct attachment to SAMSON Type 3277 Actuator
- Attachment to actuators according to IEC 60534-6 (NAMUR)
- Attachment to Type 3510 Micro-flow Valve
- Attachment to rotary actuators

NOTICE
Attach the positioner to the control valve, observing the following instructions to avoid damaging the positioner.
- *Use only the mounting parts/accessories listed in the Tables 1 to 5 (pages 40 to 42) to mount the positioner. Observe the type of attachment!*
- *Observe the assignment between lever and pin position (see travel tables on page 19)!*

Lever and pin position

The positioner is adapted to the actuator and to the rated travel by the lever on the back of the positioner and the pin inserted into the lever.

The travel tables on page 19 show the maximum adjustment range at the positioner. The travel that can be implemented at the valve is additionally restricted by the selected fail-safe position and the required compression of the actuator springs.

The positioner is standard equipped with the lever **M** (pin position **35**).

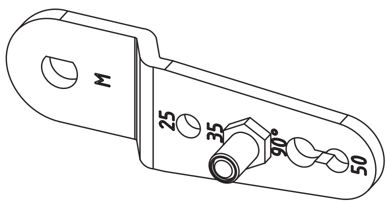


Fig. 3 · Lever M with pin position 35

Note: *If the standard mounted lever M (pin position 35) is replaced, the newly mounted lever must be moved once all the way as far as it will go in both directions to adapt it to the internal measuring lever.*

Travel tables

Note: *The lever **M** is included in the scope of delivery.*
*Levers **S**, **L**, **XL** for attachment according to IEC 60534-6 (NAMUR) are available as accessories (see Table 3 on page 41).*

Direct attachment to Type 3277-5 and Type 3277 Actuators

Actuator size [cm²]	Rated travel [mm]	Adjustment range at positioner Min.	Travel	Max.	Required lever	Assigned pin position
120	7.5	5.0	to	25.0	M	25
120/240/350	15	7.0	to	35.0	M	35
355/700	30	10.0	to	50.0	M	50

Attachment according to IEC 60534-6 (NAMUR)

SAMSON valves/Type 3271 Actuator		Other valves/actuators			Required lever	Assigned pin position
Actuator size [cm²]	Rated travel [mm]	min.	Travel	max.		
60 and 120 with Type 3510 Valve	7.5	3.6	to	18.0	S	17
120	7.5	5.0	to	25.0	M	25
120/240/350	15	7.0	to	35.0	M	35
700	7.5					
700	15 and 30	10.0	to	50.0	M	50
1000/1400/2800	30	14.0	to	70.0	L	70
1000/1400/2800	60	20.0	to	100.0	L	100
1400/2800	120	40.0	to	200.0	XL	200

Attachment to rotary actuators according to VDI/VDE 3845

Rotary actuators Min.	Opening angle	Max.	Required lever	Assigned pin position
24	to	100°	M	90°

4.1 Direct attachment

4.1.1 Type 3277-5 Actuator

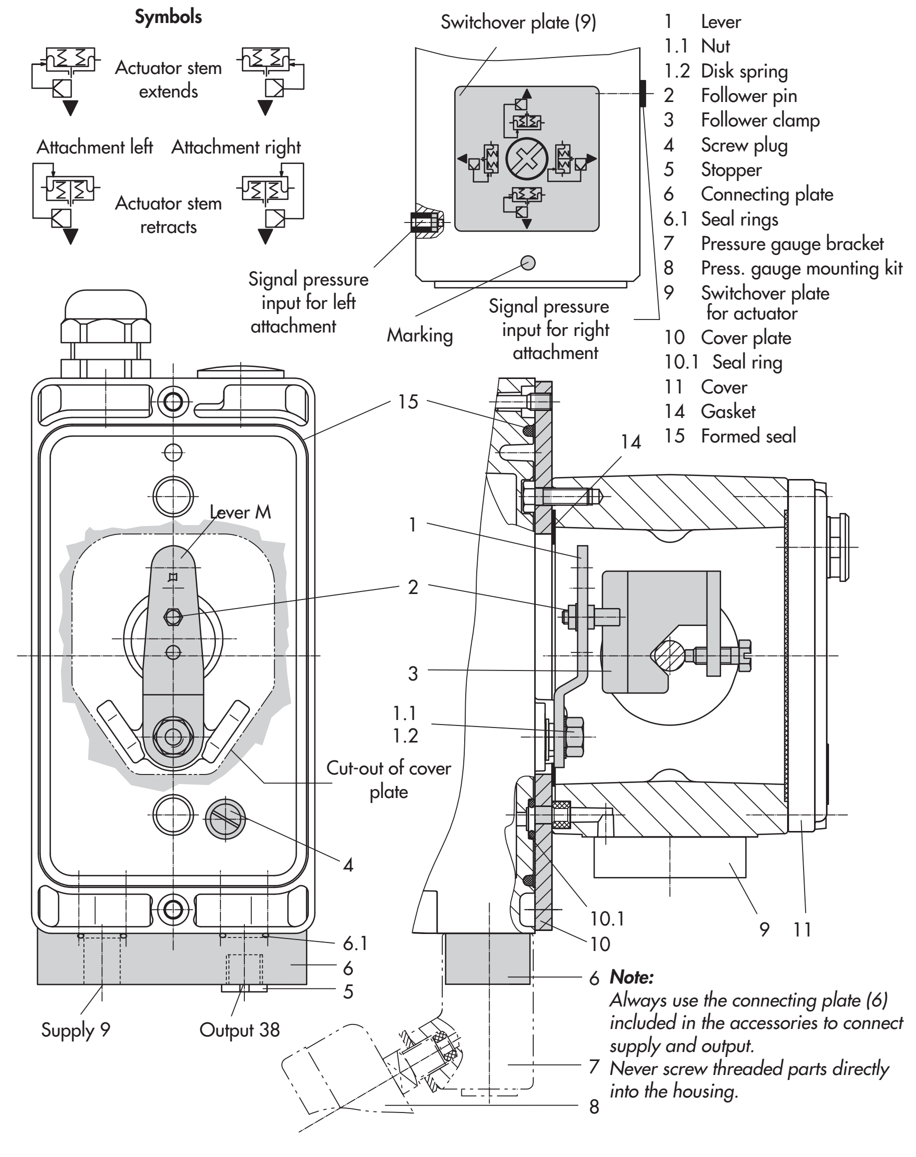
Refer to Table 1 on page 40 for the required mounting parts as well as the accessories with their order numbers.
Note the travel table on page 19!

Actuator with 120 cm²
Depending on the type of positioner attachment, the signal pressure is routed either left or right of the yoke through a bore to the actuator diaphragm. Depending on the fail-safe action of the actuator "Actuator stem extends" or "Actuator stem retracts" (valve closes or opens if the supply air fails), the switchover plate (9) must first be attached to the actuator yoke. Align the switchover plate with the corresponding symbol for left or right attachment according to the marking (view looking onto the switchover plate).

1. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges onto the positioner, making sure both seal rings (6.1) are seated properly.
2. Remove screw plug (4) on the back of the positioner and close the signal pressure output "Output 38" on the connecting plate (6) or on the pressure gauge bracket (7) with the stopper (5) included in the accessories.
3. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
4. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 4, left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
5. **15 mm travel:** Keep the follower pin (2) at lever **M** (1) on the back of the positioner in the pin position **35** (delivered state).
   7.5 mm travel: Remove the follower pin (2) from the pin position **35**, reposition it in the bore for pin position **25** and screw tight.
6. Insert formed seal (15) into the groove of the positioner housing and the seal ring (10.1) on the back of the housing.
7. Place positioner on the cover plate (10) in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 20).
   The lever (1) must rest on the follower clamp with spring force.
   Mount the positioner on the cover plate (10) using the two fixing screws.

Note for all types of attachment except for direct attachment to Type 3277-5: *The signal pressure output at the back must be sealed using the screw plug (4, order no. 0180-1254) and the associated O-ring (order no. 0520-0412).*

8. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.



Note:
Always use the connecting plate (6) included in the accessories to connect supply and output.
Never screw threaded parts directly into the housing.

Fig. 4 · Direct attachment - Signal pressure connection for Type 3277-5 Actuator with 120 cm²

4.1.2 Type 3277 Actuator

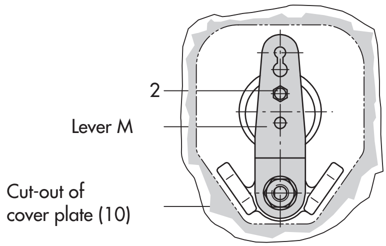
Refer to Table 2 on page 41 or the required mounting parts as well as the accessories with their order numbers.
Note the travel table on page 19!

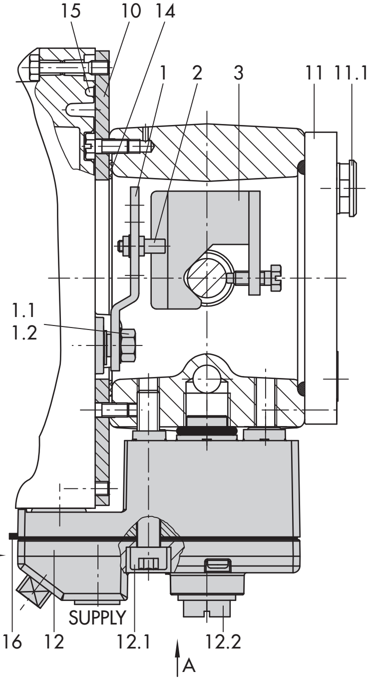
Actuators with 240 to 700 cm²

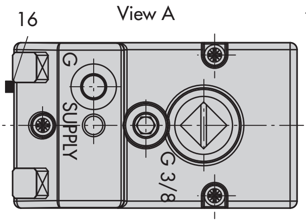
Mount the positioner on the yoke as shown in Fig. 5. The signal pressure is routed to the actuator over the connection block (12), for actuators with fail-safe action "Actuator stem extends" internally through a bore in the valve yoke and for "Actuator stem retracts" through external piping.

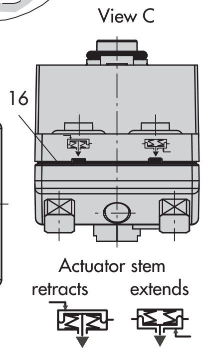
1. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
2. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 5, on the left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
3. For actuators with 355/700 cm², remove the follower pin (2) at lever **M** (1) on the back of the positioner from pin position **35**, reposition it in the bore for pin position **50** and screw tight.
   For actuators 240 and 350 cm² with 15 mm travel, the follower pin (2) remains in pin position **35**.
4. Insert formed seal (15) in the groove of the positioner casing.
5. Place positioner on the cover plate in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 20). The lever (1) must rest on the follower clamp with spring force. Mount the positioner on the cover plate (10) using the two fixing screws.
6. Make sure that the tip of the gasket (16) projecting from the side of the connection block (12) is positioned above the actuator symbol that corresponds with the actuator with fail-safe action "Actuator stem extends" or "Actuator stem retracts." If necessary, remove the three fixing screws and the cover. Then reposition the gasket (16) turned by 180°. The previous version of the connection block (Fig. 5, bottom) requires the switch plate (13) to be turned such that the corresponding actuator symbol points to the marking.
7. Place the connection block (12) with the associated seal rings against the positioner and the actuator yoke. Screw it tight using the fixing screw (12.1). For actuators with fail-safe action "Actuator stem retracts", additionally remove the stopper (12.2) and fit on the external signal pressure piping.
8. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.

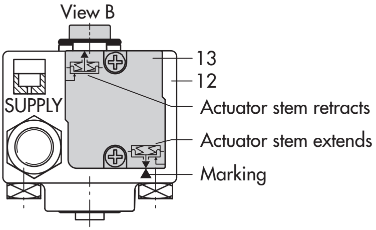
1	Lever	12	Connection block
1.1	Nut	12.1	Screw
1.2	Disk spring	12.2	Stopper or connection for external piping
2	Follower pin	13	Switch plate
3	Follower clamp	14	Gasket
10	Cover plate	15	Formed seal
11	Cover	16	Gasket
11.1	Vent plug		











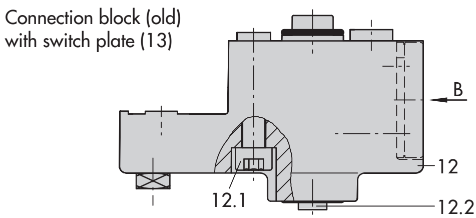


Fig. 5 · Direct attachment – Signal pressure connection for Type 3277 Actuator with 240, 350, 355 and 700 cm²

4.2 Attachment according to IEC 60534-6

Refer to Table 3 on page 41 for the required mounting parts as well as the accessories with their order numbers.
Note the travel table on page 19!

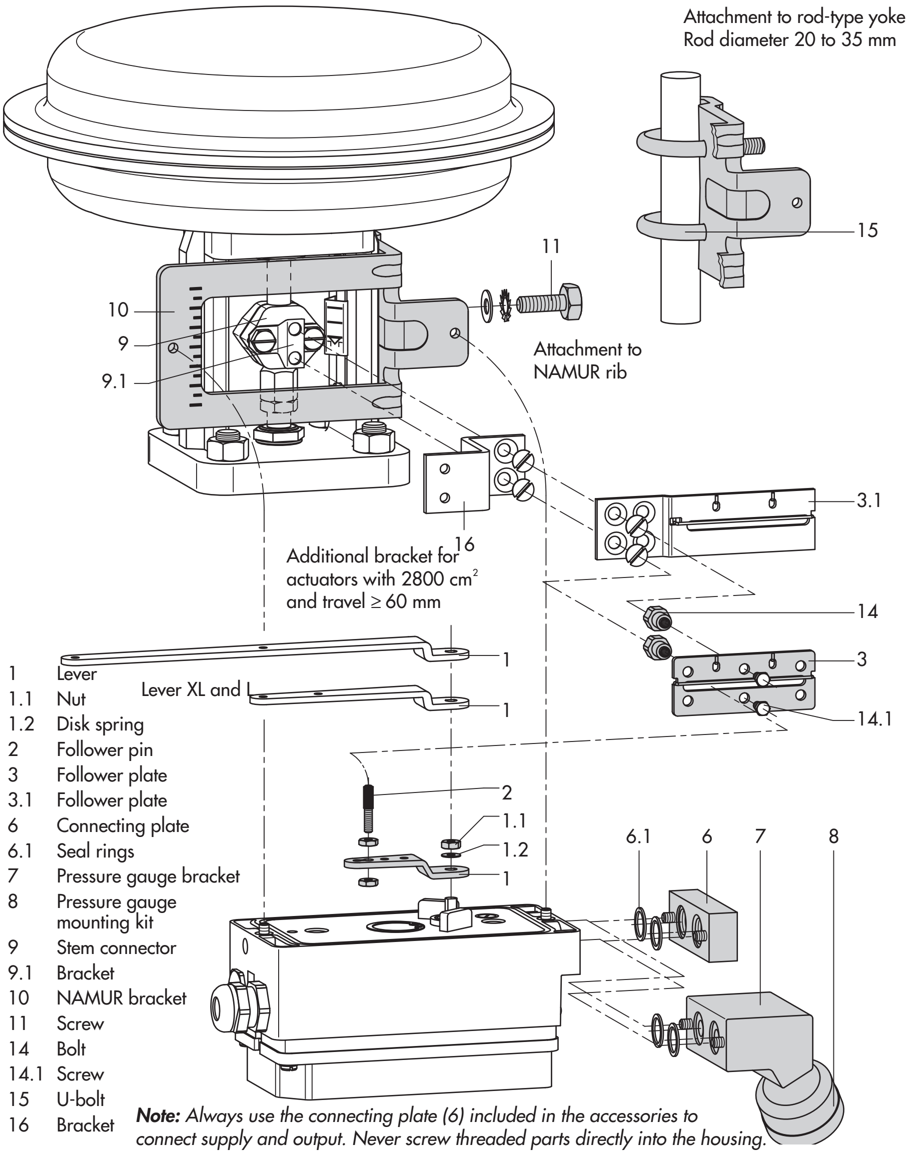
The positioner is attached to the control valve with a NAMUR bracket (10).

1. Screw the two bolts (14) to the bracket (9.1) of the stem connector (9), place the follower plate (3) on top and use the screws (14.1) to tighten.
   Actuator size 2800 cm^2 and 1400 cm^2 (120 mm travel):
   – For a travel of 60 mm or smaller, screw the longer follower plate (3.1) directly to the stem connector (9).
   – For a travel exceeding 60 mm, mount the bracket (16) first and then the follower plate (3) to the bracket together with the bolts (14) and screws (14.1).
2. Mount NAMUR bracket (10) to the control valve as follows:
   – For attachment to the NAMUR rib, use an M8 screw (11), washer, and toothed lock washer directly in the yoke bore.
   – For attachment to valves with rod-type yokes, use two U-bolts (15) around the yoke. Align the NAMUR bracket (10) in such a way that the slot of the follower plate (3) is centrally aligned with the NAMUR bracket at mid valve travel.
3. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges (8) on the positioner, making sure both seal rings (6.1) are seated properly.
4. Select required lever size (1) **M**, **L** or **XL** and pin position according to the actuator size and valve travels listed in the table on page 19.
   Should you require a pin position other than position **35** with the standard installed lever **M**, or require a lever size **L** or **XL**, proceed as follows:
5. Screw the follower pin (2) in the assigned lever bore (pin position) as listed in the table. Only use the longer follower pin (2) included in the mounting kit.
6. Place lever (1) on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).

Note: *If you have mounted a new lever (1), you must move it once all the way as far as it will go in both directions.*

---

7. Place positioner on the NAMUR bracket in such a manner that the follower pin (2) rests in the slot of the follower plate (3, 3.1). Adjust the lever (1) correspondingly.
   Screw the positioner to the NAMUR bracket using both its fixing screws.



1	Lever
1.1	Nut
1.2	Disk spring
2	Follower pin
3	Follower plate
3.1	Follower plate
6	Connecting plate
6.1	Seal rings
7	Pressure gauge bracket
8	Pressure gauge mounting kit
9	Stem connector
9.1	Bracket
10	NAMUR bracket
11	Screw
14	Bolt
14.1	Screw
15	U-bolt
16	Bracket

Note: *Always use the connecting plate (6) included in the accessories to connect supply and output. Never screw threaded parts directly into the housing.*

Fig. 6 · Attachment according to IEC 60534-6 (NAMUR)

4.3 Attachment according to VDI/VDE 3847

Only Type 3730-5xxx0xxxx0x00**6**0xx and Type 3730-5xxx0xxxx0x00**7**0xx Positioners can be attached according to VDI/VDE 3847.

The attachment of positioners according to VDI/VDE 3847 is described in detail in the TV-SK 10021 document which is available on request.

4.4 Attachment to Type 3510 Micro-flow Valve

Refer to Table 3 on page 41 for the required mounting parts as well as the accessories with their order numbers.
Note the travel table on page 19!

The positioner is attached to the valve yoke using a bracket.

1. Place clamp (3) on the valve stem connector, align at a right angle and screw tight.
2. Screw bracket (10) to the valve yoke using two screws (11).
3. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges to the positioner, making sure both seal rings (6.1) are seated properly.
4. Unscrew the standard installed lever **M** (1) including follower pin (2) from the positioner shaft.
5. Take lever **S** (1) and screw follower pin (2) in the bore for pin position **17**.
6. Place lever S on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).
   Move lever once all the way as far as it will go in both directions.
7. Place positioner on the bracket (10) in such a manner that the follower pin slides into the groove of the clamp (3). Adjust the lever (1) correspondingly.
   Screw the positioner to the bracket (10) using both its screws.

1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
3 Clamp
6 Connecting clamp
6.1 Seal rings
7 Pressure gauge bracket
8 Pressure gauge mounting kit
10 Bracket
11 Screw

Note: *Always use the connecting plate (6) included in the accessories to connect supply and output.*
Never screw threaded parts directly into the housing.

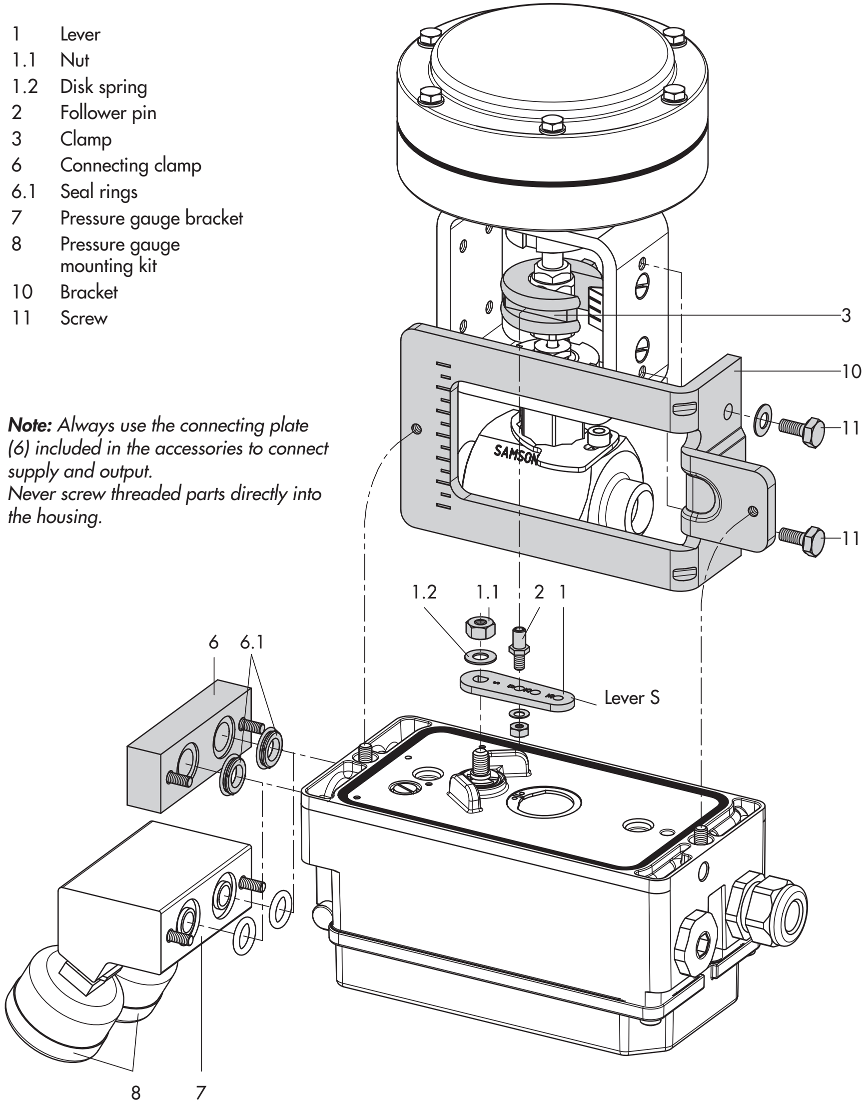


Fig. 7 · Attachment to Type 3510 Micro-flow Valve

4.5 Attachment to rotary actuators

Refer to Table 4 on page 42 for the required mounting parts as well as the accessories with their order numbers.
Note the travel table on page 19!

The positioner is mounted to the rotary actuator using two pairs of double brackets.

Prior to attaching the positioner to the SAMSON Type 3278 Rotary Actuator, mount the associated adapter (5) to the free end of the rotary actuator shaft.

Note: *On attaching the positioner as described below, it is imperative that the actuator's direction of rotation is observed.*

---

1. Place follower clamp (3) on the slotted actuator shaft or the adapter (5).
2. Place coupling wheel (4) with flat side facing the actuator on the follower clamp (3). Refer to Fig. 9 to align slot so that it matches the direction of rotation when the valve is in its closed position.
3. Screw coupling wheel and follower clamp tightly onto the actuator shaft using screw (4.1) and disk spring (4.2).
4. Screw the bottom pair of brackets (10.1) with the bends pointing either to the inside or to the outside (depending on the actuator size) to the actuator case. Position top pair of brackets (10) and screw tight.
5. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges to the positioner, making sure both O-rings are seated properly.
   For **double-acting**, springless rotary actuators, a reversing amplifier is required to attach the positioner to the actuator, see section 4.6.
6. Unscrew the standard follower pin (2) from the positioner's lever **M** (1). Use the metal follower pin (Ø5) included in the mounting kit and screw tight into the bore for pin position **90**°.
7. Place positioner on the top pair of brackets (10) and screw tight. Considering the actuator's direction of rotation, adjust lever (1) so that it engages in the slot of the coupling wheel (4) with its follower pin (Fig. 9). It must be guaranteed that the lever (1) is parallel to the long side of the positioner when the actuator is at half its angle of rotation.
8. Stick scale plate (4.3) on the coupling wheel so that the arrow tip indicates the closed position, and it can be easily read when the valve is installed.

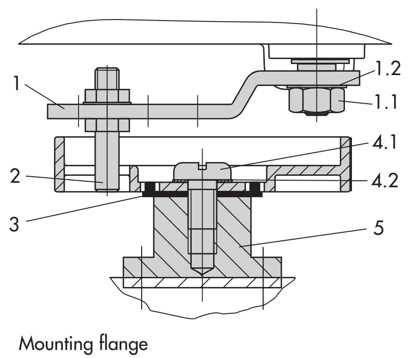
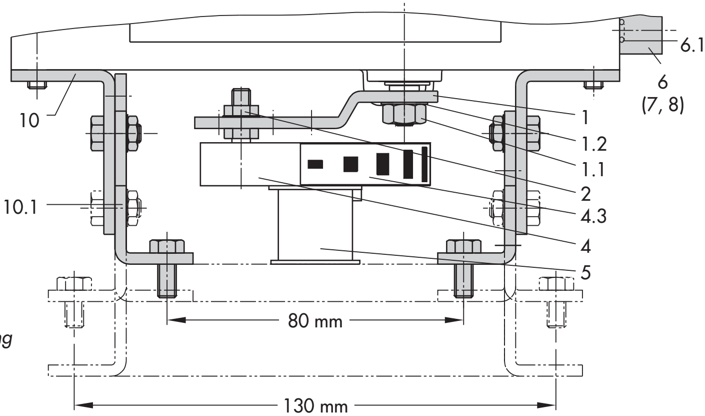
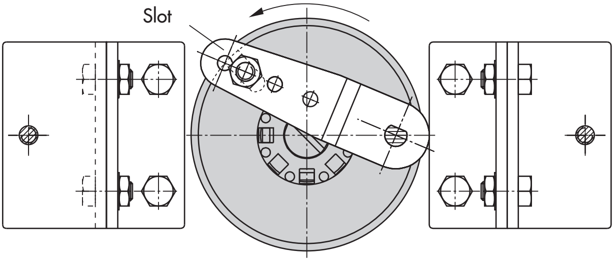


Fig. 8 · Mounting the coupling wheel with Type 3278

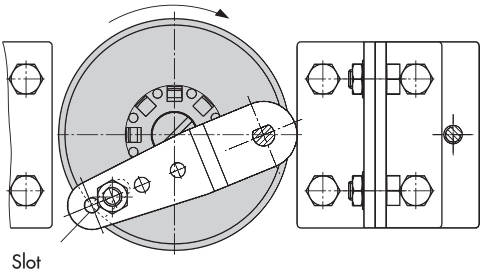


Note:
Always use the connecting plate (6) included in the accessories to connect supply and output.
Never screw threaded parts directly into the housing.



Control valve opens counterclockwise

Control valve opens clockwise



Legends Figs. 8 + 9

1	Lever
1.1	Nut
1.2	Disk spring
2	Follower pin
3	Follower clamp (Fig. 8)
4	Coupling wheel
4.1	Screw
4.2	Disk spring
4.3	Scale plate
4.3	Scale plate
5	Actuator shaft Adapter for Type 3278
6.1	Seal rings
7	Pressure gauge bracket
8	Pressure gauge mounting kit
10	Top pair of brackets
10.1	Bottom pair of brackets

Fig. 9 · Attachment to rotary actuators

4.5.1 Heavy-duty version

Refer to Table 4 on page 42 for the required mounting parts as well as the accessories with their order numbers.

Both mounting kits contain all the necessary mounting parts. First select correct actuator size. Prepare actuator, and mount required adapter supplied by the actuator manufacturer, if necessary.

1. Mount the housing (10) onto the rotary actuator. In case of VDI/VDE attachment, place spacers (11) underneath, if necessary.
2. **For SAMSON Type 3278 and VETEC S160 Rotary Actuator**, screw the adapter (5) onto the free end of the shaft or place adapter (5.1) onto the shaft of the **VETEC R Actuator.**
   Place adapter (3) onto **Type 3278, VETEC S160 and VETEC R Actuator**. For **VDI/VDE version**, this step depends on the actuator size.
3. Stick adhesive label (4.3) onto the coupling wheel in such a manner that the yellow part of the sticker is visible in the window of the housing when the valve is OPEN. Adhesive labels with explanatory symbols are enclosed and can be stuck on the housing, if required.
4. Screw tight coupling wheel (4) onto the slotted actuator shaft or adapter (3) using screw (4.1) and disk spring (4.2).
5. Undo the standard follower pin (2) on the lever M (1) of the positioner. Attach the follower pin (Ø 5) included in the mounting kit to pin position 90°.
6. If applicable, mount pressure gauge bracket (7) with pressure gauges or, in case G ¼ threaded connections are required, the connecting plate (6), making sure both seal rings (6.1) are seated properly.
   For double-acting, springless rotary actuators, a reversing amplifier is required to attach the positioner to the actuator. Refer to section 4.6.
7. For actuators with a volume of less than 300 cm^3, fit the screw-in restriction (order no.1400-6964) into the signal pressure output of the positioner (or the output of the pressure gauge bracket or connecting plate).
8. Place positioner on housing (10) and screw it tight. Considering the actuator's direction of rotation, align lever (1) so that it engages in the correct slot of the coupling wheel with its follower pin (Fig. 10).

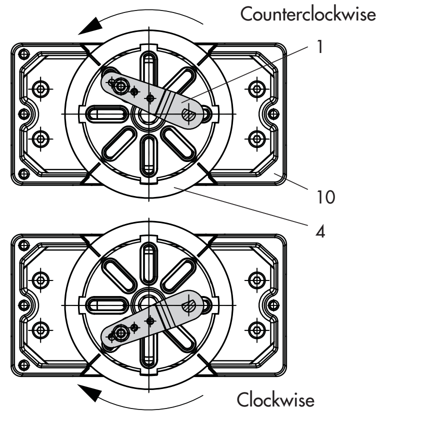


Fig. 10 · Direction of rotation

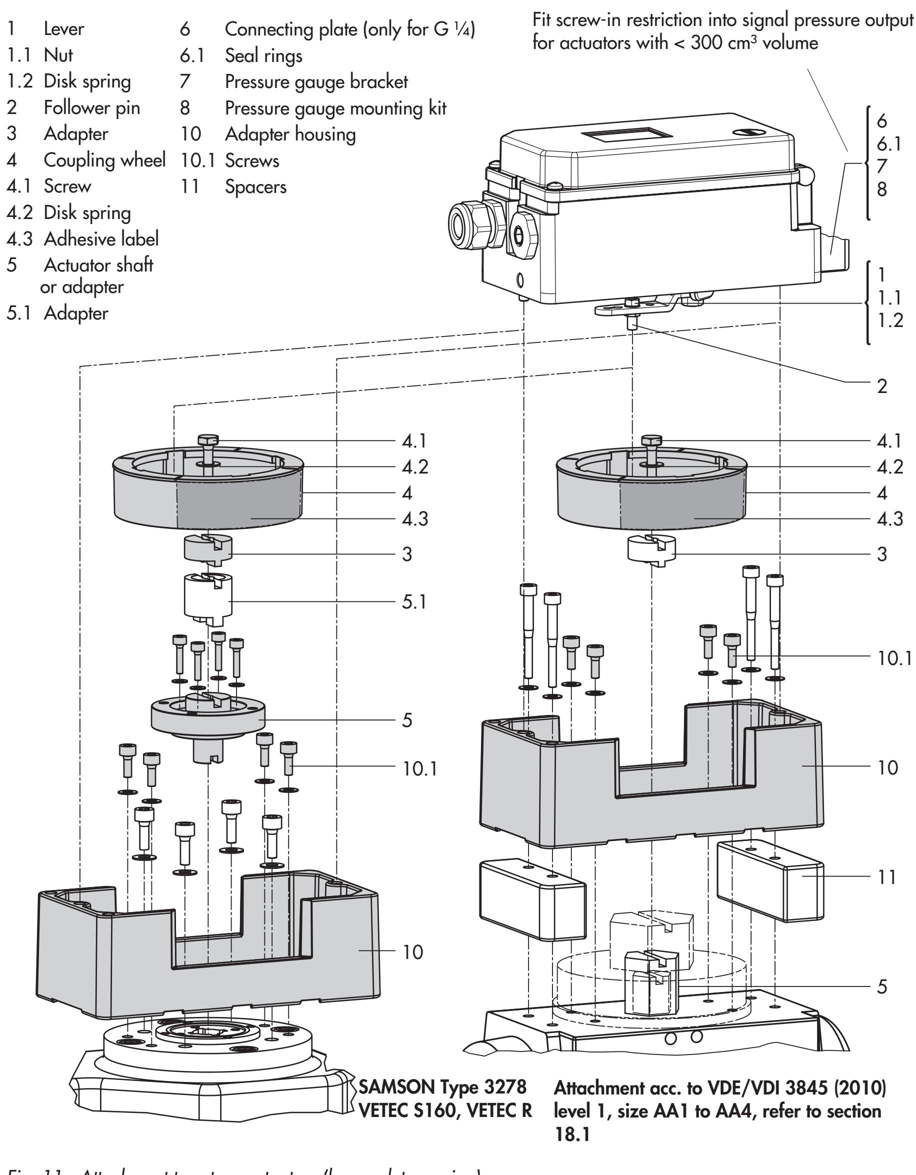


Fig. 11 · Attachment to rotary actuators (heavy-duty version)

4.6 Reversing amplifier for double-acting actuators

For the use with double-acting actuators, the positioner must be fitted with a reversing amplifier, e.g. the SAMSON Type 3710 Reversing Amplifier (see Mounting and Operating Instructions EB 8392 EN).

If a different reversing amplifier (item no. 1079-1118 or 1079-1119) is used, follow the mounting instructions described in section 4.6.1.

4.6.1 Reversing amplifier (1079-1118 or 1079-1119)

The output signal pressure of the positioner is supplied at the output $\mathbf{A_1}$ of the reversing amplifier. An opposing pressure, which equals the required supply pressure when added to the pressure at $\mathbf{A_1}$, is applied at output $\mathbf{A_2}$.
The rule $\mathbf{A_1} + \mathbf{A_2} = \mathbf{Z}$ applies.

Mounting

1. Mount the connecting plate (6) from the accessories in Table 5 to the positioner. Make sure that both O-rings (6.1) are seated correctly.
2. Thread the special nuts (1.3) from the accessories of the reversing amplifier into the boreholes of the connecting plate.
3. Insert the gasket (1.2) into the recess of the reversing amplifier and push both the hollowed special screws (1.1) into the connecting boreholes $\mathbf{A_1}$ and **Z**.
4. Place the reversing amplifier onto the connecting plate (6) and screw tight using both the special screws (1.1).
5. Use a screwdriver (8 mm wide) to screw the enclosed filters (1.6) into the connecting boreholes $\mathbf{A_1}$ and **Z**.

NOTICE
Do not unscrew the sealing plug (1.5) out of the reversing amplifier.
The rubber seal (1.4) is not required and can be removed when the sealing plug is used.

Signal pressure connections

$\mathbf{A_1}$: Output $\mathbf{A_1}$ leading to the signal pressure connection at the actuator which opens the valve when the pressure increases

$\mathbf{A_2}$: Output $\mathbf{A_2}$ leading to the signal pressure connection at the actuator which closes the valve when the pressure increases

- Set slide switch on positioner to **AIR TO OPEN**.

6. After the initialization is completed, set Code 16 (Pressure limit) to ***OFF***.

Pressure gauge attachment

The mounting sequence shown in Fig. 12 remains unchanged. Screw a pressure gauge bracket onto the connections $\mathbf{A_1}$ and **Z**.

Pressure gauge bracket:	G ¼	1400-7106
	¼ NPT	1400-7107

Pressure gauges for supply air Z and output A_1 as listed in Tables 1 to 4.

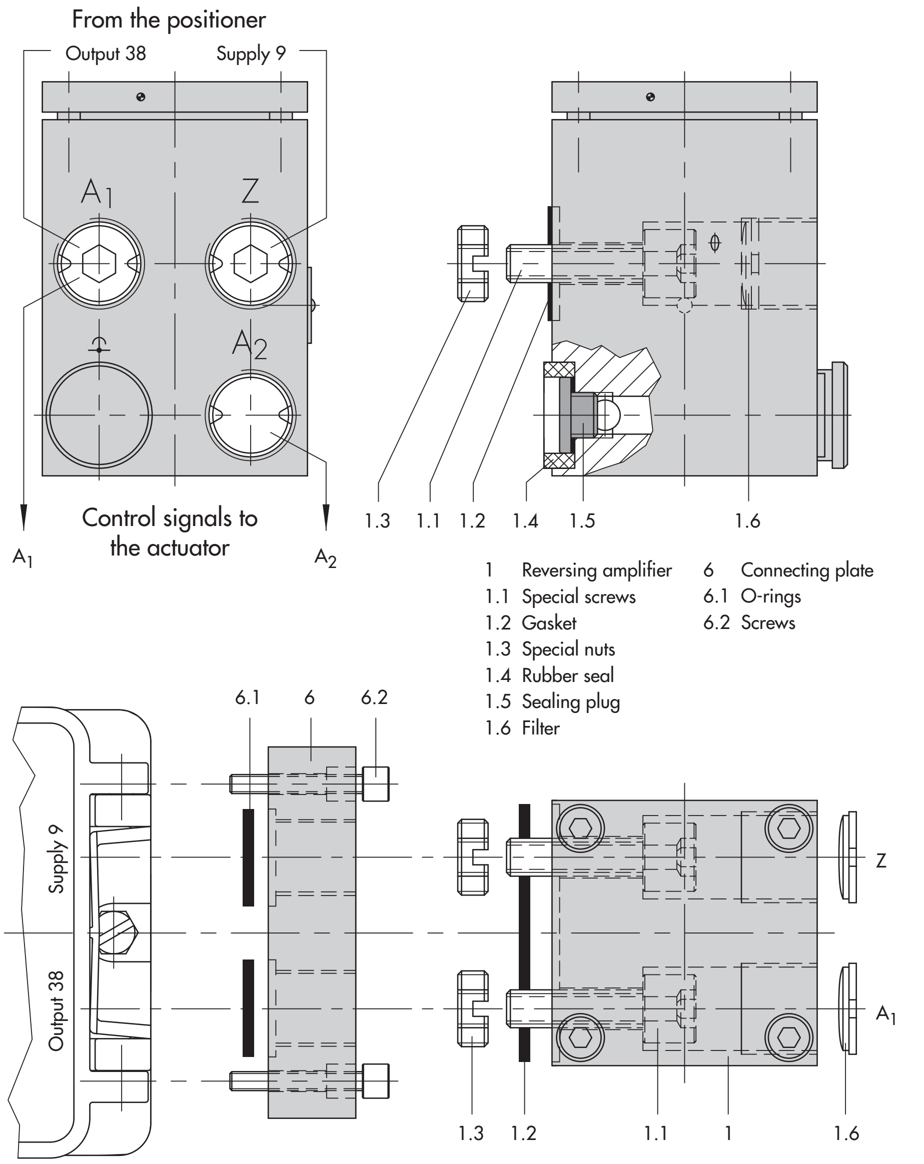


Fig. 12 · Mounting a reversing amplifier (1079-1118 or 1079-1119)

4.7 Attaching an external position sensor

Refer to Table 6 on p. 43 for the mounting parts as well as the accessories required.

In the positioner version with an external position sensor, the sensor placed in a separate housing is attached over a plate or bracket to the control valve. The travel pick-off corresponds to that of a standard device.
The positioner unit can be mounted as required to a wall or a pipe.



Fig. 13 · Positioner unit with sensor mounted on a micro-flow valve

For the pneumatic connection either a connecting plate (6) or a pressure gauge bracket (7) must be fixed to the housing, depending on the accessory chosen. Make sure the seal rings (6.1) are correctly inserted (see Fig. 6, bottom right).

For the electrical connection a 10 meter connecting lead with M12x1 connectors is included in the scope of delivery.

Note:

– *In addition, the instructions in sections 5.1 and 5.2 apply for the pneumatic and electrical connection.*
Operation and setting are described in sections 6 and 7.

– *Since 2009, the back of the position sensor (20) is fitted with two pins acting as mechanical stops for the lever (1). If this position sensor is mounted using old mounting parts, two corresponding Ø 8 mm holes must be drilled into the mounting plate/bracket (21). A template is available for this purpose. Refer to Table 6 on page 43.*

4.7.1 Mounting the position sensor with direct attachment

Type 3277-5 Actuator with 120 cm²

The signal pressure from the positioner is routed over the signal pressure connection of the connecting plate (9, Fig. 14 left) to the actuator diaphragm chamber. To proceed, first screw the connecting plate (9) included in the accessories onto the actuator yoke.

- Turn the connecting plate (9) so that the correct symbol for the fail-safe position "Actuator stem extends" or "Actuator stem retracts" is aligned with the marking (Fig. 14, below).
- Make sure that the gasket for the connecting plate (9) is correctly inserted.
- The connecting plate has boreholes with NPT and G threads.
  Seal the threaded connection that is not used with the rubber seal and square plug.

Type 3277 Actuator with 240 to 700 cm²:

The signal pressure is routed to the connection at the side of the actuator yoke for the

version "Actuator stem extends".
For the fail-safe position "Actuator stem retracts" the connection on the top diaphragm case is used. The connection at the side of the yoke must be fitted with a venting plug (accessories).

Mounting the position sensor

1. Place the lever (1) on the sensor in mid-position and hold it in place. Unthread the nut (1.1) and remove the lever together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the mounting plate (21).
3. Depending on the actuator size and rated valve travel, determine the required lever and position of the follower pin (2) from the travel table on page 19. The positioner is delivered with lever **M** in pin position **35** on the sensor. If necessary, remove the follower pin (2) from its pin position and move it to the borehole for the recommended pin position and screw tight.
4. Place the lever (1) and disk spring (1.2) on the sensor shaft.
   Place the lever (1) **in mid-position** and **hold it in place**. Screw on the nut (1.1).
5. Place the follower clamp (3) on the actuator stem, align and fasten it, making sure that the fastening screw rests in the groove of the actuator stem.
6. Place the mounting plate (21) together with the sensor onto the actuator yoke so that the follower pin (2) rests on the top

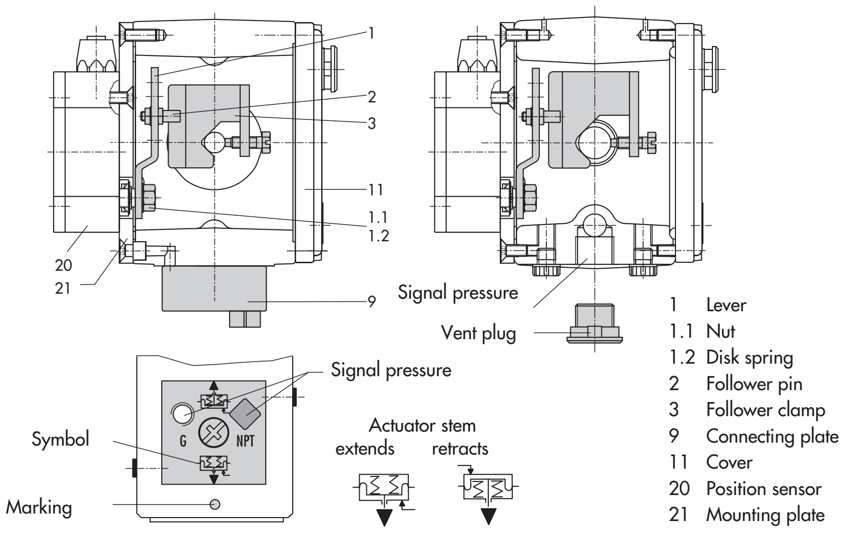


Fig. 14 · Mounting for Type 3277-5 Actuator (left) and Type 3277 Actuator (right)

of the follower clamp (3). It must rest on it with spring force.
Screw tight the mounting plate (21) onto the actuator yoke using both fixing screws.

7. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.

4.7.2 Mounting the position sensor with attachment according to IEC 60534-6

For the required mounting parts and the accessories, refer to Table 6 on page 43.

1. Place the lever (1) on the sensor **in mid-position** and **hold it in place**.
Unthread the nut (1.1) and remove the lever together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the bracket (21).

The standard attached lever **M** with the follower pin (2) at position **35** is designed for 120, 240 and 350 cm² actuators with 15 mm rated travel.

For other actuator sizes or travels, select the lever and pin position from the travel table on page 19. Lever **L** and **XL** are included in the mounting kit.

3. Place the lever (1) and disk spring (1.2) on the sensor shaft.
Place the lever (1) **in mid-position** and **hold it in place**. Screw on the nut (1.1).
4. Screw both bolts (14) to the bracket (9.1) of the stem connector (9). Attach

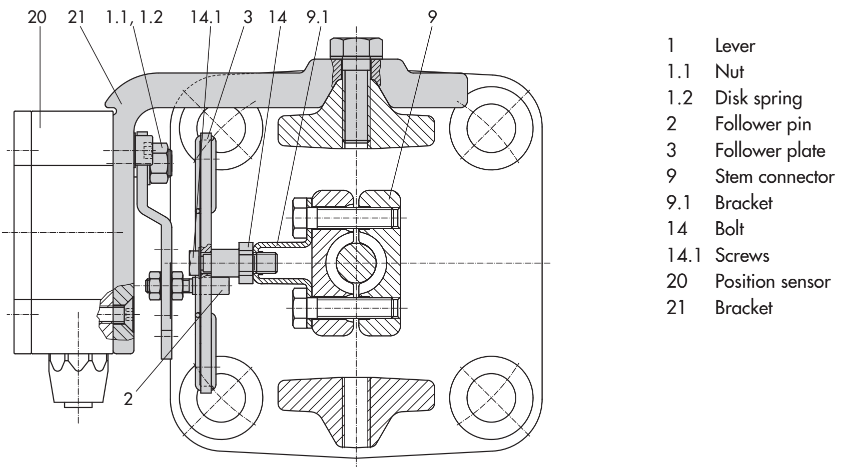


Fig. 15 · Mounting according to IEC 60534-6 (NAMUR)

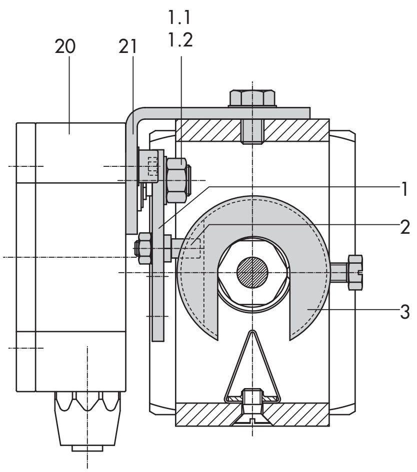
the follower plate (3) and fix with the screws (14.1).

5. Place the bracket with the sensor at the NAMUR rib in such a manner that the follower pin (2) rests in the slot of the follower plate (3), then screw the bracket using its fixing screws onto the valve.

4.7.3 Mounting the position sensor to Type 3510 Micro-flow Valve

For the required mounting parts and the accessories, refer to Table 6 on page 43.

1. Place the lever (1) **in mid-position** and **hold it in place**. Unscrew the nut (1.1) and remove the standard attached lever **M** (1) together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the bracket (21).
3. Select the lever **S** (1) from the accessories and screw the follower pin (2) into the hole for pin position **17**.
   Place the lever (1) and disk spring (1.2) on the sensor shaft.
   Place the lever (1) in mid-position and hold it in place. Screw on the nut (1.1).
4. Place the follower clamp (3) on the stem connector, align it at a right angle and screw tight.
5. Position the bracket (21) with the position sensor on the valve yoke and screw tight, making sure the follower pin (2) slides into the groove of the follower clamp (3).



1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
3 Follower clamp
20 Position sensor
21 Bracket

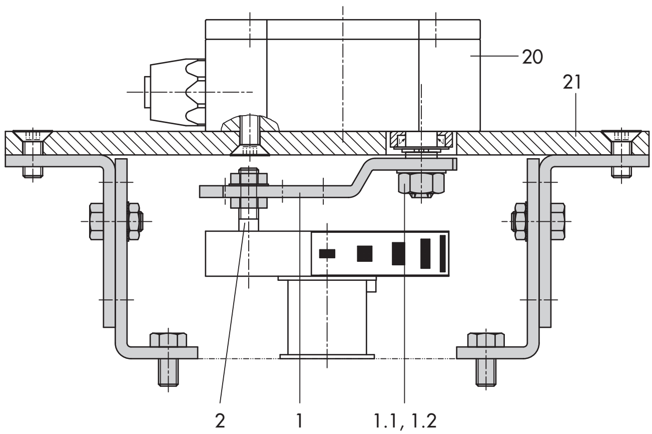
Fig. 16 · Mounting on a micro-flow valve

4.7.4 Mounting the position sensor to rotary actuators

For the required mounting parts and the accessories, refer to Table 6 on page 43.

1. Place the lever (1) **in mid-position** and **hold it in place**. Unscrew the nut (1.1) and remove the standard attached lever **M** (1) together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the mounting plate (21).
3. Replace the follower pin (2) normally attached to the lever (1) with the metal follower pin (Ø 5) from the accessories and screw it into the hole for pin position 90°.
4. Place the lever (1) and disk spring (1.2) on the sensor shaft.
   Place the lever (1) **in mid-position** and **hold it in place**. Screw on the nut (1.1).

Follow the instructions describing attachment to the standard positioner in section 4.5 Instead of the positioner, attach the position sensor (20) with its mounting plate (21).



1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
20 Position sensor
21 Mounting plate

Fig. 17 · Positioner unit with sensor mounted on rotary actuators

4.8 Attaching positioners with stainless steel housings

Positioners with stainless steel housings require mounting parts that are completely made of stainless steel or free of aluminum.

Note: *The pneumatic connecting plate and a pressure gauge bracket are available in stainless steel (order number listed below). The Type 3710 Pneumatic Reversing Amplifier is also available in stainless steel.*

Connecting plate (stainless steel):	G ¼ ¼ NPT	1400-7476 1400-7477
Pressure gauge bracket (st. steel):	G ¼ ¼ NPT	1402-0265 1400-7108

The Tables 1 to 5 (pages 40 and 42) apply for attaching positioners with stainless steel housings with the following restrictions:

Direct attachment
All mounting kits from Tables 1 and 2 can be used. The connection block is not required. The stainless steel version of the pneumatic connecting plate routes the air internally to the actuator.

Attachment according to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes)
All mounting kits from Table 3 can be used. Connecting plate in stainless steel.

Attachment to rotary actuators
All mounting kits from Table 4 can be used except for the heavy-duty version. Connecting plate in stainless steel.

4.9 Air purging function for single-acting actuators

The exhaust air from the positioner is diverted to the actuator spring chamber to provide corrosion protection inside the actuator. The following must be observed:

Direct attachment to Type 3277-5 (stem extends FA/stem retracts FE)
The air purging function is automatically provided.

Direct attachment to Type 3277, 240 to 700 cm²
FA: Remove the stopper 12.2 (Fig. 5 on page 23) at the connection block and make a pneumatic connection to the spring chamber on the vented side.

NOTICE
The method described does not apply to old connection blocks in powder-paint-coated aluminum. In this case, follow the instructions for attachment described below in "Attachment according to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes) and to rotary actuators".

FE: The air purging function is automatically provided.

Attachment according to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes) and to rotary actuators
The positioner requires an additional port for the exhaust air that can be connected

over piping. An adapter available as an accessory is used for this purpose:

Threaded bushing (M20 x 1.5):	G ¼	0310-2619
	¼ NPT	0310-2550

NOTICE
The adapter uses one of the M20 x 1.5 connections in the housing which means ***just one*** *cable gland can be installed.*

Should other valve accessories be used which vent the actuator (e.g. solenoid valve, volume booster, quick exhaust valve), this exhaust air must also be included in the purging function. The connection over the adapter at the positioner must be protected with a check valve (e.g. check valve G ¼, order no. 8502-0597) mounted in the piping. Otherwise the pressure in the positioner housing would rise above the ambient pressure and damage the positioner when the exhausting components respond suddenly.

4.10 Mounting parts and accessories

Table 1 · Direct attachment to Type 3277-5 Actuator (Fig. 4)			Order no.
Mounting parts	Mounting parts for actuators 120 cm^2 or smaller		1400-7452
Accessories for the actuator	Switchover plate **old** for Actuator Type 3277-5xxxxxx.**00** (old)		1400-6819
	Switchover plate **new** for Actuator Type 3277-5xxxxxx.**01** (new) [1]		1400-6822
	Connecting plate **new** for Actuator Type 3277-5xxxxxx.**01** (new) [1]: G ¼ and ¼ NPT		1400-6823
	Connecting plate **old** for Actuator Type 3277-5xxxxxx.**00** (old): G ¼		1400-6820
	Connecting plate **old** for Actuator Type 3277-5xxxxxx.**00** (old): ¼ NPT		1400-6821
Accessories for the positioner	Connecting plate (6)	G ¼	1400-7461
		¼ NPT	1400-7462
	Pressure gauge bracket (7)	G ¼	1400-7458
		¼ NPT	1400-7459
	Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)	St. steel/brass	1400-6950
		St. steel/St. st.	1400-6951

1) Only new switchover and connecting plates can be used with new actuators (Index 01). Old and new plates are not interchangeable.

Table 2 · Direct attachment to Type 3277 Actuator (Fig. 5)				Order no.
Mounting parts	Attachment to actuators with 240, 350, 355, 700 cm²			1400-7453
Accessories	Required piping with screw fittings – for "Actuator stem retracts" – when the top diaphragm chamber is filled with air	240 cm²	Steel	1400-6444
			Stainless steel	1400-6445
		350 cm²	Steel	1400-6446
			Stainless steel	1400-6447
		355 cm²/ 700 cm²	Steel	1400-6448
			Stainless steel	1400-6449
	Connection block with seals and screw		G ¼	1400-8819
			¼ NPT	1400-8820
	Pressure gauge mounting kit up to max. 6 bar (output and supply)		St. steel/brass	1400-6950
			St. steel/st. steel	1400-6951

Table 3 · Attachment to NAMUR ribs or control valves with rod-type yokes (20 to 35 mm rod diameter) according to IEC 60534-6 (Figs. 6 and 7)				
Travel in mm	**Lever**	**For actuators**		Order no.
7.5	S	Type 3271-5 with 60/120 cm² on Type 3510 Valve (Fig. 7)		1400-7457
5 to 50	M 1)	Actuators from other manufacturers and Type 3271 with 120 to 700 cm²		1400-7454
14 to 100	L	Actuators from other manufacturers and Type 3271, versions 1000 and 1400-60		1400-7455
40 to 200	XL	Actuators from other manufacturers and Type 3271, versions 1400-120 and 2800 cm² with 120 mm travel		1400-7456
30 or 60	L	Type 3271, versions 1400-120 and 2800 cm² with 30/60 mm travel		1400-7466
		Mounting bracket for Emerson and Masoneilan linear actuators In addition, a mounting kit acc. to IEC 60534-6 is required depending on the travel. See row above.		1400-6771
		Valtek Type 25/50		1400-9554
Accessories	Connecting plate (6)		G ¼	1400-7461
			¼ NPT	1400-7462
	Pressure gauge bracket (7)		G ¼	1400-7458
			¼ NPT	1400-7459
	Pressure gauge mounting kit up to max. 6 bar (output/supply)		St. steel/brass	1400-6950
			St. steel/st. st.	1400-6951

1) Lever M is mounted on basic device (included in the scope of delivery)

<table>
<tr><th colspan="3">Table 4 · Attachment to rotary actuators (Figs. 8 and 9)</th><th>Order no.</th></tr>
<tr><td rowspan="7">Mounting parts</td><td colspan="2">Attachment acc. to VDI/VDE 3845 (September 2010), refer to section 18.1 for details</td><td></td></tr>
<tr><td colspan="2">Actuator surface corresponds to level 1
Size AA1 to AA4, version with CrNiMo steel bracket
Size AA1 to AA4, heavy-duty version
Heavy-duty version (e.g. Air Torque 10 000)</td><td>
1400-7448
1400-9244
1400-9542</td></tr>
<tr><td colspan="2">Bracket surface corresponds to level 2, heavy-duty version</td><td>1400-9526</td></tr>
<tr><td colspan="2">Attachment for SAMSON Type 3278 with 160/320 cm², CrNiMo steel bracket</td><td>1400-7614</td></tr>
<tr><td colspan="2">Attachment for SAMSON Type 3278 with 160 cm² and for VETEC Type S160, Type R and Type M, heavy-duty version</td><td>1400-9245</td></tr>
<tr><td colspan="2">Attachment for SAMSON Type 3278 with 320 cm² and for VETEC Type S320, heavy-duty version</td><td>1400-5891
and
1400-9526</td></tr>
<tr><td colspan="2">Attachment to Camflex II</td><td>1400-9120</td></tr>
<tr><td rowspan="6">Accessories</td><td rowspan="2">Connecting plate (6)</td><td>G ¼</td><td>1400-7461</td></tr>
<tr><td>¼ NPT</td><td>1400-7462</td></tr>
<tr><td rowspan="2">Pressure gauge bracket (7)</td><td>G ¼</td><td>1400-7458</td></tr>
<tr><td>¼ NPT</td><td>1400-7459</td></tr>
<tr><td rowspan="2">Pressure gauge mounting kit up to max. 6 bar (output/supply)</td><td>St. steel/brass</td><td>1400-6950</td></tr>
<tr><td>St. steel/st. steel</td><td>1400-6951</td></tr>
</table>

<table>
<tr><th colspan="4">Table 5 · General accessories</th></tr>
<tr><td rowspan="11">Accessories</td><td colspan="2">Pneumatic reversing amplifier for double-acting actuators</td><td>Type 3710</td></tr>
<tr><td colspan="2">Cable gland M20 x 1.5, nickel-plated brass</td><td>1890-4875</td></tr>
<tr><td colspan="2">EMC cable gland M20 x 1.5</td><td>8808-0143</td></tr>
<tr><td colspan="2">Adapter M 20 x 1.5 to ½ NPT, aluminum</td><td>0310-2149</td></tr>
<tr><td colspan="2">Retrofit kit for inductive limit switch 1x SJ 2-SN</td><td>1400-7460</td></tr>
<tr><td>Cover plate with list of parameters and operating instructions</td><td>German/English (standard)</td><td>1990-5328</td></tr>
<tr><td colspan="2">EXPERT+ activation code for Type 3730-5 Positioner</td><td>1400-9318</td></tr>
<tr><td colspan="2">USB dongle for EXPERT+ (specify the number of positioners to be activated)
Can only be used in combination with TROVIS-VIEW 6661-1058</td><td>1400-9555</td></tr>
<tr><td colspan="2">TROVIS-VIEW with device module 3730-5</td><td>1262295</td></tr>
<tr><td colspan="2">Serial interface adapter (SAMSON SSP interface - RS-232 port on computer)</td><td>1400-7700</td></tr>
<tr><td colspan="2">Isolated USB interface adapter (SAMSON SSP interface - USB port on computer) including TROVIS-VIEW CD-ROM</td><td>1400-9740</td></tr>
</table>

Table 6 · Attachment of external position sensor			Order no.
Template for mounting the position sensor on older mounting parts. See note on page 34.			1060-0784
Direct attachment	Mounting parts for actuators with 120 cm² see Fig. 14 left		1400-7472
	Connecting plate (9, old) for Actuator Type 3277-5xxxxxx.**00**	G ⅛	1400-6820
		⅛ NPT	1400-6821
	Connecting plate (new) for Actuator Type 3277-5xxxxxx.**01** (new) 1)		1400-6823
	Mounting parts for actuators with 240, 350, 355 and 700 cm², see Fig. 14 right		1400-7471
NAMUR attachmt.	Mounting parts for attachment to NAMUR rib w. lever L and XL, see Fig. 15		1400-7468
Micro-flow valve	Mounting parts for Type 3271 Actuator with 60 cm², see Fig. 16		1400-7469
Attachment to rotary actuators	VDI/VDE 3845 (September 2010), refer to section 18.1 for details		
	Actuator surface corresponds to level 1		
	Size AA1 to AA4 with follower clamp and coupling wheel, version with CrNiMo steel bracket, see Fig. 17		1400-7473
	Size AA1 to AA4, heavy-duty version		1400-9384
	Size AA5, heavy-duty version (e.g. Air Torque 10 000)		1400-9992
	Bracket surface corresponds to level 2, heavy-duty version		1400-9974
	SAMSON Type 3278 with 160 cm² (also for VETEC Type S160 and Type R), heavy-duty version		1400-9385
	SAMSON Type 3278 with 320 cm² and for VETEC Type S320, heavy-duty version		1400-5891 and 1400-9974
Accessories for positioner	Connecting plate (6)	G ¼	1400-7461
		¼ NPT	1400-7462
	Pressure gauge bracket (7)	G ¼	1400-7458
		¼ NPT	1400-7459
	Pressure gauge mounting kit up to max. 6 bar (output/supply)	St. steel/brass	1400-6950
		St. steel/st. steel	1400-6951
	Bracket to mount the positioner on a wall **Note:** The other fastening parts are to be provided at the site of installation as wall foundations vary from site to site.		0309-0111

1) Only new switchover and connecting plates can be used with new actuators (Index 01). Old and new plates are **not** interchangeable.

5 Connections

WARNING!
Mount the positioner, keeping the following sequence:
1. Remove protective film from pneumatic connections.
2. Mount the positioner on the control valve
3. Connect the supply air
4. Connect the electrical power
5. Perform the start-up settings

The connection of the electrical auxiliary power may cause the actuator stem to move, depending on the operating mode.
Do not touch the actuator stem or obstruct it to avoid risk of injury to hands or fingers.

5.1 Pneumatic connections

NOTICE
Follow the instructions below to avoid damaging the positioner.
- *The threaded connections in the positioner housing are not designed direct air connection!*
- *The screw glands must be screwed into the connecting plate, the pressure gauge mounting block or the connection block from the accessories.*
  The air connections are optionally designed as a bore with ¼ NPT or G ¼ thread.
  The customary fittings for metal and copper pipes or plastic hoses can be used.
- *The supply air must be dry and free from oil and dust.*
  The maintenance instructions for upstream pressure reducing stations must be observed.
  Blow through all air pipes and hoses thoroughly prior to connecting them.

If the positioner is attached directly to the Type 3277 Actuator, the connection of the positioner's output pressure to the actuator is fixed. For attachment according to IEC 60534-6 (NAMUR), the signal pressure can be routed to either the top or bottom diaphragm chamber of the actuator, depending on the actuator's fail-safe action "Actuator stem extends" or "Actuator stem retracts".
For rotary actuators, the manufacturer's specifications for connection apply.

5.1.1 Signal pressure gauges

To monitor the supply air (Supply) and signal pressure (Output), we recommend that pressure gauges be attached (see accessories in Tables 1 to 5).

5.1.2 Supply pressure

The required supply air pressure depends on the bench range and the actuator's operating direction (fail-safe action).
The bench range is registered on the nameplate either as spring range or signal pressure range depending on the actuator. The direction of action is marked **FA** or **FE**, or by a symbol.

Actuator stem extends FA (AIR TO OPEN)

Fail-safe position "Valve Closed"
(for globe and angle valves):

Required supply pressure = Upper bench range value + 0.2 bar, minimum 1.4 bar.

Actuator stem retracts FE (AIR TO CLOSE)

Fail-safe position "Valve Open"
(for globe and angle valves):
For tight-closing valves, the maximum signal pressure pst_{max} is roughly estimated as follows:

$$pst_{max} = F + \frac{d^2 \cdot \pi \cdot \Delta p}{4 \cdot A} \text{ [bar]}$$

d = Seat diameter [cm]
Δp = Differential pressure across the valve [bar]
A = Actuator diaphragm area [cm²]

If there are no specifications, calculate as follows:

Required supply pressure =
Upper bench range value + 1 bar.

5.1.3 Signal pressure (output)

The signal pressure at the output (Output 38) of the positioner can be limited to 1.4, 2.4 or 3.7 bar in Code **16**.

The limitation is not activated [OFF] by default.

5.2 Electrical connections

DANGER!
Risk of electric shock and/or the formation of an explosive atmosphere!

- *For electrical installation, observe the relevant electrotechnical regulations and the accident prevention regulations that apply in the country of use.*
- *The following regulations apply to mounting and installation in hazardous areas: EN 60079-14: 2008* ***Explosive atmospheres – Part 14: Electrical installations design, selection and erection*** *(or VDE 0165 Part 1).*

NOTICE

- *Adhere to the terminal assignment!*
- *Switching the assignment of the electrical terminals may cause the explosion protection to become ineffective!*
- *Do not loosen enameled screws in or on the housing.*
- *The maximum permissible values specified in the national EC type examination certificates apply when interconnecting intrinsically safe electrical equipment (U_i or U_o; I_i or I_o; P_i or P_o; C_i or C_o, and L_i or L_o).*

Selecting cables and wires:

Observe ***Clause 12 of EN 60079-14: 2008*** *when installing intrinsically safe circuits. The Subclause 12.2.2.7 applies when running multi-core cables containing more than one intrinsically safe circuit.*

In particular, the radial thickness of the conductor insulation for common insulation materials, such as polyethylene, must have a minimum radial thickness of 0.2 mm.

The diameter of an individual wire in a fine-stranded conductor must not be smaller than 0.1 mm. Protect the conductor ends against splicing, e.g. by using wire-end ferrules.

When two separate cables are used for connection, an additional cable gland can be installed.

Seal cable entries left unused with plugs.

Devices used at ambient temperatures ***below –20 °C*** *must be fitted with metal cable glands.*

Equipment for use in zone 2/zone 22

In equipment operated with type of protection Ex nA II (non-sparking equipment) according to EN 60079-15: 2003, circuits may be connected, interrupted or switched while energized only during installation, maintenance or repair.

Equipment connected to energy-limited circuits with type of protection Ex nL (energy-limited equipment) according to EN 60079-15: 2003 may be switched under normal operating conditions.

The maximum permissible values specified in the Statement of Conformity or its addenda apply when interconnecting the equipment with energy-limited circuits in type of protection Ex nL IIC.

Cable entries

The cable entry with M20 x 1.5 cable gland, 6 to 12 mm clamping range.
There is a second M20 x 1.5 threaded bore in the housing that can be used for additional connection, when required.
The screw terminals are designed for wire cross-sections of 0.2 to 2.5 mm². Tighten by at least 0.5 Nm.

Note: *The power supply for the positioner can be supplied either over the connection to the fieldbus segment or over a DC voltage source (9 to 32 V) connected to the bus terminals in the positioner.*
You are required to observe the relevant regulations for use in hazardous areas.

Accessories

Cable gland M20 x 1.5:
– Black plastic Order no. 8808-1011
– Blue plastic Order no. 8808-1012
– Nickel-plated brass Order no. 1890-4875
– Stainless steel 1.4305 Order no. 8808-0160

EMC cable gland M20 x 1.5:
– Nickel-plated brass Order no. 8808-0143

Adapter M20 x 1.5 to ½ NPT:
– Aluminum, powder-coated Order no. 0310-2149
– Stainless steel Order no. 1400-7114

Bus line
Route the two-wire bus line to the screw terminals marked "IEC 1158-2", whereby no polarity has to be observed.

NOTICE
To connect the limit switch, binary inputs, and forced venting, an additional cable gland that needs to be fitted in place of the existing blanking plug is necessary.
Open cable glands are not permissible as the degree of protection IP 66 only applies when the positioner housing is sealed.

Limit switch
For operation of the limit switches, switching amplifiers have to be connected in the output circuit. Their function is to control the limit values of the control circuit according to EN 60947-5-6, thus ensuring operational reliability of the positioner. If the positioner is installed in hazardous areas, the relevant regulations must be observed.

Binary input 1
An active contact can be operated at binary input 1. The positioner can report the switching state over the bus protocol.

Binary input 2
A passive, floating contact can be operated at binary input 2.
The positioner can report the switching state over the bus protocol.

Solenoid valve (forced venting function)
For positioners fitted with the optional solenoid valve for the forced venting function, a voltage of 24 V DC must be connected to the relevant terminals +81 and –82.

NOTICE
If there is no voltage connected for the solenoid valve at terminals +81 and –82 or when the voltage signal is interrupted, the positioner vents the actuator and does not respond to the reference variable.
Observe the switching thresholds specified in the technical data.

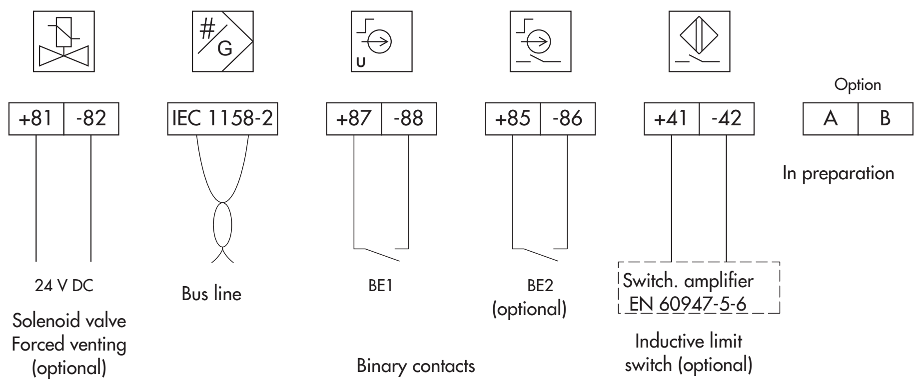


Fig. 18 · Electrical connections

5.2.1 Establishing communication

The communication structure between the controller, logic solvers (PLC) or automation system, or between a PC or work station and the positioner(s) is implemented to conform with IEC 61158-2.

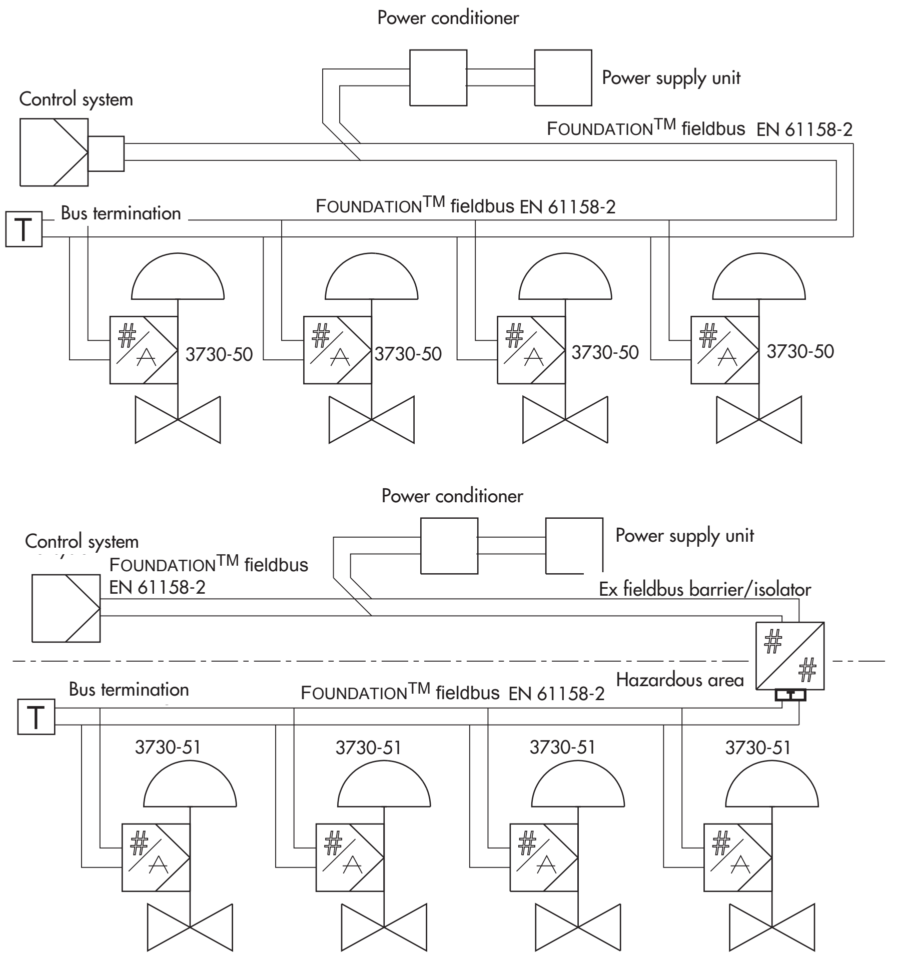


Fig. 19 · Connection acc. to FOUNDATION™ fieldbus, without (top) and with explosion protection (bottom)

6 Operator controls and readings

Rotary pushbutton

The rotary pushbutton is located underneath the front protective cover.
The positioner is operated on site using the rotary pushbutton:

Turn to select codes and values.

Press to confirm setting.

Slide switch AIR TO OPEN or AIR TO CLOSE

- AIR TO OPEN applies when the increasing signal pressure opens the valve
- AIR TO CLOSE applies when the increasing signal pressure closes the valve

The signal pressure is the air pressure at the output of the positioner which is transferred to the actuator.
For positioners with an attached reversing amplifier for double-acting rotary actuators (section 4.6): switch position AIR TO OPEN.

Volume restriction Q

The volume restriction is used to adapt the air delivery to the actuator size. Two fixed settings are possible depending on how the air is routed at the actuator:

- For actuators smaller than 240 cm^2 with a loading pressure connection at the side (Type 3271-5), set restriction to MIN SIDE.
- For a connection at the back (Type 3277-5), set restriction to MIN BACK.
- For actuators 240 cm^2 and larger, set to MAX SIDE for a side connection and to MAX BACK for a connection at the back.

Readings on display

Icons appear on the display that are assigned to parameters, codes and functions.

Operating modes:

Manual mode (MAN), section 8.2.1
Automatic mode (AUTO), section 8.2.1
S Fail-safe position (SAFE), section 8.2.2

- **Bar elements:**
  In manual and automatic modes, the bars indicate the system deviation that depends on the sign (+/–) and the value. One bar element appears per 1 % system deviation.
  If the device has not yet been initialized, the icon blinks on the display and the lever position in degrees in relation to the longitudinal axis is indicated. One bar element corresponds to approximately a 5° angle of rotation.
  If the fifth bar element blinks (reading > 30°), the permissible angle of rotation has been exceeded. Lever and pin position must be checked.
- **Status alarms**
  : Maintenance alarm
  : Maintenance required/Maintenance demanded
  These icons indicate that an error has occurred.
  A classified status can be assigned to each error. Classifications include "No message", "Maintenance required", "Maintenance demanded" and "Maintenance alarm" (see section 8.3).
- **Configuration enabled**
  This indicates that the codes marked with an asterisk (*) in the code list (section 17.1) are enabled for configuration (see section 8.1).

Displays and their meaning

AUtO	Automatic mode	***RES***	Reset
CL	Clockwise	***RUN***	Start
CCL	Counterclockwise	***SAFE***	Fail-safe position
Err	Error	***SUb***	Substitute calibration
ESC	Escape	***TunE***	Initialization in progress
LOW	w too small	***YES***	Available
MAN	Manual mode	***ZP***	Zero calibration
MAX	Maximum range	***tEStinG***	Test function active
NO	Not available		
NOM	Nominal travel	↗↗	Increasing/increasing
ON	ON	↗↘	Increasing/decreasing
OFF	OFF		

and ⟳ together ☝
AO Transducer Block is in the MAN mode, see page 128

⟳ blinking Emergency mode (see error code 62 on p. 92)

☝ blinking Not initialized

S blinking Valve in mechanical fail-safe position (see SET_FAIL_ SAFE_POS parameter in the AO Transducer Block, page 132)

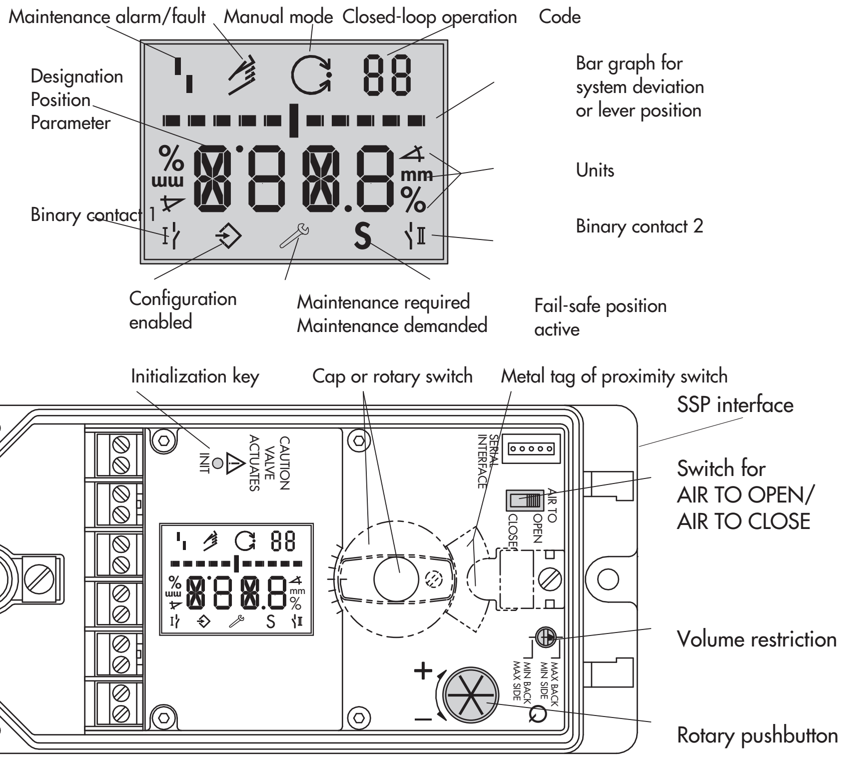


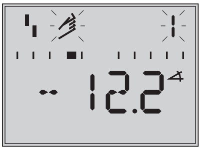
Fig. 20 · Display and operator controls

7 Start-up – Settings

WARNING!
Mount the positioner, keeping the following sequence:
1. *Remove protective film from pneumatic connections.*
2. *Mount the positioner on the control valve*
3. *Connect the supply air*
4. *Connect the electrical power*
5. ***Perform the start-up settings***

Reading on display after connecting the electrical auxiliary power:

- ***tEStinG*** runs across the display and then the fault alarm icon appears and blinks on the display when the positioner has **not yet been initialized**. The reading indicates the lever position in degrees in relation to the longitudinal axis.



Reading when the positioner has not yet been initialized

- If Code ***0*** appears on the display when a positioner has been **initialized**. The positioner is in the last active operating mode.

WARNING!
The actuator stem moves while the start-up settings are being performed.
Do not touch the actuator stem or obstruct it to avoid risk of injury to hands or fingers.

NOTICE
Perform the start-up settings in the same sequence as listed (section 7.1 to section 7.6).

Note: *The positioner performs a test in the start-up phase while following its automation task at the same time. During the start-up phase, operation on site is unrestricted, yet write access is limited.*

7.1 Defining the valve closed position

To adapt the positioner to the operating direction of the actuator, set slide switch to AIR TO OPEN or AIR TO CLOSE .

- **AIR TO OPEN** = Signal pressure opens the valve, for fail-safe position: actuator stem extends/fail close
- **AIR TO CLOSE** = Signal pressure closes the valve, for fail-safe position: actuator stem retracts/fail open.

NOTICE
*The AIR TO OPEN **(AtO)** setting always applies to double-acting actuators.*

For checking purposes:
After successfully completing initialization, the positioner display should read 0 % when the valve is closed and 100 % when the valve is open. If this is not the case, change the slide switch position and re-initialize the positioner.

__Note:__ The switch position is prompted prior to an initialization. After an initialization has been completed, changing the switch position does not have any effect on the operation of the positioner.
The positioner only needs to be initialized again after the fail-safe action of the actuator has been changed.

7.2 Setting the volume restriction Q

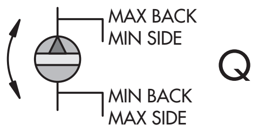


Fig. 21 · Volume restriction Q
MAX BACK/MIN SIDE setting

The volume restriction Q is used to adapt the air delivery to the size of the actuator:

- Actuators with a **transit time < 1 s**, e.g. linear actuators with an effective area smaller than 240 cm², require a restricted air flow rate (MIN).
- Actuators with a **transit time ≥ 1 s** do not require the air flow rate to be restricted (MAX).

The position of volume restriction Q also depends on how the signal pressure is routed at the actuator in **SAMSON actuators**:

- The “SIDE“ position applies for actuators with a loading pressure connection at the side, e.g. Type 3271-5.
- The “BACK“ position applies for actuators with a loading pressure connection at the back, e.g. in Type 3277-5.
- The “SIDE”restriction position always applies for actuators from other manufacturers.

Overview · Position of volume restriction Q*

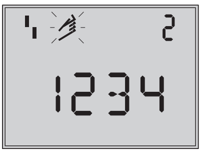
Signal pressure \ **Transit time**	< 1 s	≥ 1 s
Connection at the side	MIN SIDE	MAX SIDE
Connection at the back	MIN BACK	MAX BACK

* Intermediate positions are not permitted.

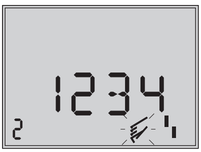
NOTICE
The positioner needs to be initialized again after the position of the restriction has been changed.

7.3 Adapting the display

The data representation on the positioner display can be turned by 180° to adapt it to how the positioner is mounted.



Reading direction for right attachment of pneumatic connections



Reading direction for left attachment of pneumatic connections

If the displayed data appear upside down, proceed as follows:

Turn → Code ***2***

Press → Code ***2*** blinks.

Turn → Required direction

Press to confirm reading direction.

7.4 Limiting the signal pressure

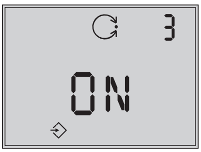
If the maximum actuator force may cause damage to the valve, the signal pressure must be limited.

NOTICE

*Do not activate the pressure limit function in double-acting actuators (with valve closed position AIR TO OPEN (**OFF** = default) as it is determined automatically during initialization.*

Enable configuration at the positioner before activating the pressure limit function:

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*



Configuration enabled
Default: ***OFF***

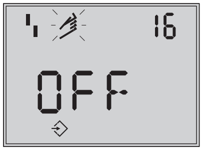
Turn → Code **3**, display: ***OFF***

Press → Code ***3*** blinks.

Turn → ***ON***

Press → display

Limiting the signal pressure:



Pressure limit
Default: ***OFF***

Turn → Code **16**

Press → Code ***16*** blinks.

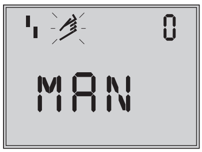
Turn until the required pressure limit (1.4/2.4/3.7 bar) appears.

Press to confirm the pressure limit setting.

7.5 Checking the operating range of the positioner

To check the mechanical attachment and the proper functioning, the valve should be moved through the operating range of the positioner in the manual operating mode with the manual reference variable.

Selecting manual operating mode:



Operating mode
Default ***MAN***

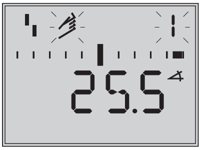
Turn → Code **0**

Press → Code ***0*** blinks.

Turn → ***MAN***

Press . The positioner changes to the manual operating mode.

Checking the operating range:



Manual reference variable w (current angle of rotation is indicated)

Turn → Code **1**

Press → Code ***1*** and blink.

Turn until the pressure in the positioner builds up, and the control valve moves to its final positions so that the travel/angle of rotation can be checked.
The angle of rotation on the back of the positioner is indicated. A horizontal lever (mid position) is equal to 0°.

To ensure the positioner is working properly, the outer bar elements may not blink while the valve is moving through the operating range.
Exit Code **1** by pressing the rotary pushbutton ( ).

The permissible range has been exceeded when the displayed angle is greater than 30°, and the outer right or left bar element blinks.
The positioner changes to the fail-safe position (***SAFE***).
After canceling the fail-safe position (SAFE) (see section 8.2.2) it is **absolutely necessary** to **check** the lever and pin position as described in section 4.

WARNING!
To avoid personal injury or property damage caused by the supply air or electrical auxiliary power, disconnect the supply air and electrical auxiliary power (bus line) before exchanging the lever or changing the pin position.

7.6 Initialization

WARNING!
During initialization, the control valve moves through its entire travel/angle of rotation range. Therefore, do not start the initialization procedure while a process is running, but only during start-up when all shut-off valves are closed.

Before starting initialization, check the maximum permissible signal pressure of the control valve. During initialization, the positioner issues an output signal pressure up to the maximum supply pressure supplied. If necessary, limit the signal pressure by connecting an upstream pressure reducing valve.

NOTICE
After the positioner has been mounted on to another actuator or its mounting location has been changed and prior to re-initializing the positioner, the positioner needs to be reset to its basic setting (default values). Refer to section 7.8.

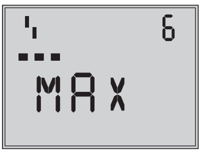
During initialization the positioner adapts itself optimally to the friction conditions and the signal pressure demand of the control valve. The type and extent of self-adaptation depends on the set initialization mode:

- ***MAX*** **maximum range** (standard range)
  Initialization mode for simple start-up of

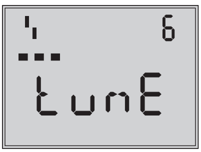
valves with two clearly defined mechanical end positions, e.g. three-way valves (see section 7.6.1)

- ***NOM* nominal range**
  Initialization mode for all globe valves (see section 7.6.2)
- ***MAN* manually selected range**
  Initialization mode for globe valves with an unknown nominal range (see section 7.6.3)
- ***SUB* substitute calibration** (emergency mode)
  This mode allows a positioner to be replaced while the plant is running, with the least amount of disruption to the plant (see section 7.6.4)

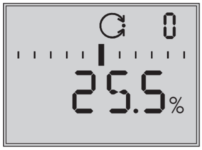
Note: *For normal operation, simply start initialization by pressing the INIT key after mounting the positioner on the valve and defining the valve closed position and setting the volume restriction. The positioner only needs to work with its default settings. If necessary, perform a reset (see section 7.8).*



Alternating displays
Initialization running
Symbol depending on initialization mode selected



Bar graph display indicating the progress of the initialization



Initialization successful, positioner in automatic operating mode

The time required for an initialization process depends on the transit time of the actuator and take several minutes.

After a successful initialization, the positioner runs in closed-loop operation indicated by ↻.

A malfunctioning leads to the process being canceled. The initialization error appears on the display according to how it has been classified by the condensed state. See section 8.3.

Note: *Positioner with extended EXPERT*$^+$ *diagnostics automatically start to plot the reference graphs (drive signal steady-state d1 and hysteresis d2) after initialization has been completed.* ***tESt d1*** *or* ***tESt d2*** *appear on the display in an alternating sequence.*
An error during the plotting of the reference graphs is indicated on the display by Code ***81****.*
The positioner still works properly, even though the reference graph plotting has not been completed successfully.

Valve closed position AIR TO CLOSE

If the slide switch is set to AIR TO CLOSE, the positioner automatically switches to the direction of action increasing/decreasing (↗↘) on successful completion of initialization.
This results in the following assignment between reference variable and valve position:

Valve closed position	Direction of action	Reference variable Valve Closed at	Open at
AIR TO OPEN	↗↗	0 %	100 %
AIR TO CLOSE	↗↘	100 %	0 %

The tight-closing function is activated.

NOTICE
*Set Code **15** (final position w>) to 99 % for three-way valves.*

Canceling an initalization process

The initialization procedure can be canceled while running by pressing the rotary pushbutton (⊛). **StOP** appears three seconds long and the positioner then changes to the fail-safe position (SAFE).

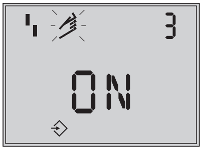
Exit the fail-safe position again over Code **0** (see section 8.2.2).

7.6.1 MAX – Initialization based on maximum range

The positioner determines travel/angle of rotation of the closing member from the CLOSED position to the opposite side and adopts this travel/angle of rotation as the operating range from 0 to 100 %.

Enable configuration:

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*



Default ***OFF***

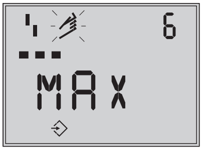
Turn ⊛ → Code **3**, display: ***OFF***

Press ⊛ → Code **3** blinks

Turn ⊛ → ***ON***

Press ⊛, display

Select the initialization mode:



Initialization mode
Default ***MAX***

Turn ⊛ → Code ***6***

Press ⊛

Turn ⊛ → ***MAX***

Press ⊛ to confirm the ***MAX*** as the initialization mode.

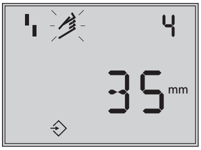
Start initialization:

- Press INIT key to start initialization!

The nominal travel/angle of rotation is indicated in % after initialization. Code ***5*** (nominal range) remains locked. The parameters for travel/angle range start (Code ***8***) and travel/angle range end (Code ***9***) can also only be displayed and modified in %.

For a reading in mm/°, enter the pin position (Code ***4***).

Enter the pin position:



Pin position
Default ***OFF***

Turn → Code ***4***

Press , Code ***4*** blinks

Turn → Pin position on lever (see relevant section on attachment)

Press . The reading of the nominal range appears in mm/°.

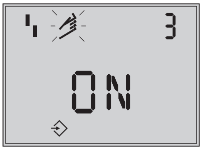
7.6.2 NOM – Initialization based on nominal range

The calibrated sensor allows the effective valve travel to be set very accurately. During the initialization process, the positioner checks whether the control valve can move through the indicated nominal range (travel or angle) without collision.
If this is the case, the indicated nominal range is adopted with the limits of travel/angle range start (Code **8**) and travel/angle range end (Code **9**) as the operating range.

Note: *The maximum possible travel must always be greater than the nominal travel entered. If this is not the case, initialization is interrupted (error alarm Code* ***52****) because the nominal travel is not achieved.*

Enable configuration:

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*



Default ***OFF***

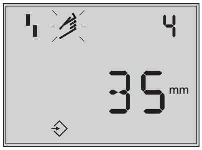
Turn → Code ***3***, display: ***OFF***

Press , Code ***3*** blinks

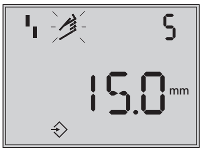
Turn → ***ON***

Press , display ⇾

Enter the pin position and nominal range:



Pin position
Default ***OFF***



Nominal range
(locked with Code **4** = No)

Turn → Code ***4***

Press , Code ***4*** blinks

Turn → Pin position on lever (see relevant section on attachment)

Press .

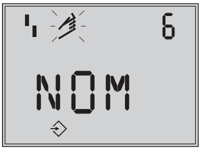
Turn → Code ***5***

Press , Code ***5*** blinks

Turn → Nominal travel/angle

Press .

Select the initialization mode:



Initialization mode
Default ***MAX***

Turn → Code ***6***

Press , Code ***6*** blinks

Turn → ***NOM***

Press to confirm the ***NOM*** as the initialization mode.

Start initialization:

- Press INIT key to start initialization!

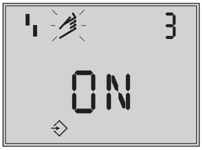
Note: *After initialization, check the direction of action and, if necessary, change it (Code **7**).*

7.6.3 MAN – Initialization based on a manually selected range

Before starting initialization, move the control valve manually to the OPEN position by turning in small steps. The valve must move to the required valve position with a monotonically increasing signal pressure. The positioner calculates the differential travel/angle using the OPEN and CLOSED positions and adopts it as the operating range with limits of travel/angle range start (Code ***8***) and travel/angle range end (Code ***9***).

Enable configuration:

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*



Default ***OFF***

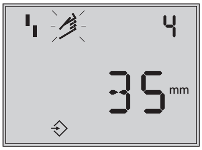
Turn → Code ***3***

Press , Code ***3*** blinks

Turn → ***ON***

Press , display

Enter the pin position:



Pin position
Default ***OFF***

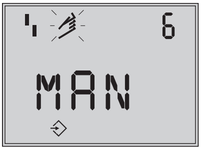
Turn → Code ***4***

Press , Code ***4*** blinks

Turn → Pin position on lever (see relevant section on attachment)

Press . The reading of the nominal range appears in mm/°.

Select the initialization mode:



Initialization mode
Default ***MAX***

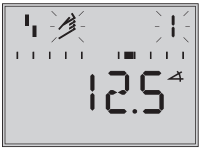
Turn → Code ***6***

Press, Code ***6*** blinks

Turn → ***MAN***

Press to confirm the ***MAN*** as the initialization mode.

Enter OPEN position:



Manual reference variable (the current angle of rotation is displayed)

Turn → Code ***0***

Press, Code ***0*** blinks

Turn → ***MAN***

Press

Turn → Code ***1***

Press, Code ***1*** blinks

Turn until the valve reaches its OPEN position.

Press to confirm the OPEN position.

Start initialization:

- Press INIT key to start initialization!

7.6.4 SUb substitute calibration

A complete initialization procedure takes several minutes and requires the valve to move through its entire travel range several times. This initialization mode, however, is an emergency mode, in which the control parameters are estimated and not determined by an initialization procedure. As a result, a high level of accuracy cannot be expected. You should always select a different initialization mode if the plant allows it.

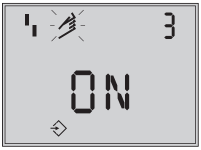
The ***SUb*** initialization mode is used to replace a positioner while the process is running. For this purpose, the control valve is usually fixed mechanically in a certain position, or pneumatically by means of a pressure signal which is routed to the actuator externally. The blocking position ensures that the plant continues to operate with this valve position.

By entering the blocking position (Code ***35***), closing direction (Code ***34***), pin position (Code ***4***), nominal range (Code ***5***) and direction of action (Code ***7***), the positioner can calculate the positioner configuration.

NOTICE
Perform a reset before re-initializing the positioner if the substitute positioner has already been initialized. Refer to section 7.8.

Enable configuration:

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*



Default ***OFF***

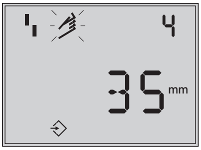
Turn ⊛ → Code ***3***

Press ⊛, Code ***3*** blinks

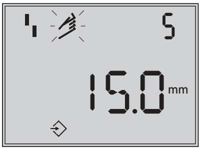
Turn ⊛ → ***ON***

Press ⊛, display ⇨

Enter the pin position and nominal range:



Default ***OFF***



Nominal range
(locked with Code **4** = No)

Turn ⊛ → Code ***4***

Press ⊛, Code ***4*** blinks

Turn ⊛ → Pin position on lever (see relevant section on attachment)

Press ⊛.

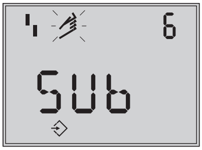
Turn ⊛ → Code ***5***

Press ⊛, Code ***5*** blinks

Turn ⊛ → Nominal travel/angle

Press ⊛.

Select the initialization mode:



Initialization mode
Default ***MAX***

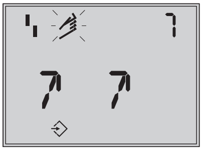
Turn ⊛ → Code ***6***

Press ⊛, Code ***6*** blinks

Turn ⊛ → ***SUb***

Press ⊛ to confirm the ***SUb*** as the initialization mode.

Enter the direction of action:



Default ↗↗

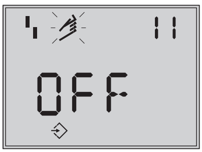
Turn ⊛ → Code ***7***

Press ⊛, Code ***7*** blinks

Turn ⊛ → Direction of action (↗↗ or ↗↘)

Press ⊛.

Deactivate travel limit:



Default ***100.0***

Turn ⊛ → Code ***11***

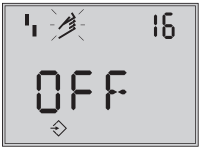
Press ⊛, Code ***11*** blinks

Turn ⊛ → ***OFF***

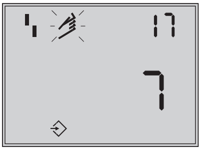
Press ⊛.

Change pressure limit and control parameters:

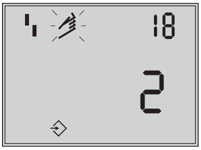
Note: *Do not change the pressure limit (Code* ***16****). Only change the control parameters* K_P *(Code* ***17****) and* T_V *(Code* ***18****) if the settings of the the replaced positioner are known.*



Pressure limit
Default ***OFF***



KP
Default ***7***



TV
Default ***2***

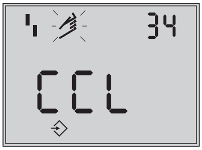
Turn → Code ***16/17/18***

Press , Code ***16/17/18*** blinks

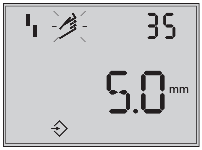
Turn to set the control parameter selected.

Press to confirm the setting.

Enter closing direction and blocking position:



Closing direction
Direction of rotation causing the valve to move to the CLOSED position (view onto positioner display)
Default: CCL (counterclockwise)



Blocking position
Default: 0

Turn → Code ***34***

Press , Code ***34*** blinks

Turn → Closing direction (CCL counterclockwise/CL clockwise)

Press .

Turn → Code ***35***

Press , Code ***35*** blinks

Turn → Blocking position, e.g. 5 mm (read off at travel indicator scale of the blocked valve or measure with a ruler).

Press to confirm the setting.

Set the valve closed position:

- Set switch for **valve closed position** AIR TO OPEN or AIR TO CLOSE as described in section 7.1 on page 51.
- Set volume restriction as described in section 7.2 on page 52.

Start initialization:

- Press INIT key!
  The positioner switches to ***MAN*** operating mode.
  The blocking position is indicated.

Note: *As initialization has not been carried out completely, the error code* ***76*** *(no emergency mode) and possibly also error code* ***57*** *(control loop) may appear on the display.*
These alarms do not influence the positioner's readiness for operation.

Cancel the blocking position and change to automatic operating mode

For the positioner to follow its reference variable again, the blocking position must be canceled and the positioner must be set to ⟳ automatic operating mode as follows:

Turn ⊛ → Code ***1***

Press ⊛, Code ***1*** and ☝ blink

Turn ⊛ in order to move the valve slightly past the blocking position.

Press ⊛ to cancel mechanical blocking.

Turn ⊛ → Code ***0***

Press ⊛, Code ***0*** blinks.

Turn ⊛ → ***AUtO***

Press ⊛. The positioner switches to automatic operating mode. The current valve position is indicated in %.

Note: *If the positioner shows a tendency to oscillate in automatic operating mode, the parameters K_P and T_V must be slightly corrected. Proceed as follows:*
Set T_V to 4 (Code ***18****).*
If the positioner still oscillates, the gain K_P (Code ***17****) must be decreased until the positioner shows a stable behavior.*

Zero point calibration

Finally, if process operations allow it, the zero point must be adjusted according to section 7.7.

7.7 Zero calibration

In case of discrepancies with the closing position of the valve, e.g. with soft-sealed plugs, it may become necessary to recalibrate the zero point.

We recommend re-initializing the positioner in case of deviations in the zero point over 5 %.

NOTICE
The valve briefly moves from the current travel/angle of rotation position to the closed position.

Note: *The positioner must be connected to the supply air to perform the zero calibration.*

Enable configuration:

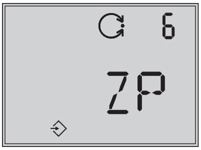
Turn ⊛ → Code **3**

Press ⊛, Code **3** blinks

Turn ⊛ → ***ON***

Press ⊛, display ⇾

Perform zero calibration:



Initialization mode
Default ***MAX***

Turn ⊛ → Code ***6***

Press ⊛, Code **6** blinks

Turn ⊛ → ***ZP***

Press ⊛.

- **Press INIT key!**

Zero calibration is started, the positioner moves the control valve to the CLOSED position and readjusts the internal electrical zero point.

7.8 Reset to default values

This function resets all parameters to the factory default values (see code list in section 17.1).

Enable configuration:

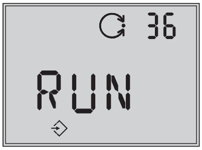
Turn ⊛ → Code **3**

Press ⊛, Code **3** blinks

Turn ⊛ → ***ON***

Press ⊛, display ⇾

Reset start-up parameters:



Reset
Default ***OFF***

Turn ⊛ → Code ***36***

Press ⊛, Code **36** blinks

Turn ⊛ → ***RUN***

Press ⊛. All start-up parameters are reset to their default values.

7.9 Start-up via local interface (SSP)

The positioner can either be commissioned, configured and operated on site or by using the fieldbus configuration or operating system over the fieldbus. Alternatively, the TROVIS-VIEW operator interface can be used.

The positioner has an digital serial interface, which is connected to the RS-232 or USB port of a computer using an adapter cable (see Table 5 on page 42).

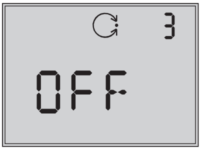
The positioner can be supplied with power by connecting it to a fieldbus segment or over a DC voltage source (9 to 32 V) connected to the bus terminals in the positioner. The simultaneous operation of TROVIS-VIEW and the fieldbus system is possible without any restrictions when connected to a FOUNDATION™ fieldbus bus segment.

8 Operation

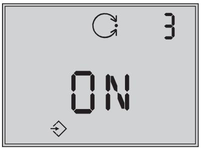
WARNING!
The actuator stem moves while the positioner is being operated.
Do not touch the actuator stem or obstruct it to avoid risk of injury to hands or fingers.

8.1 Enabling and selecting parameters

The codes which are marked with an asterisk (*) in section 17.1 on page 77 onwards must be enabled with Code 3 before the associated parameters can be configured as described below.



Code ***3***
Configuration not enabled



Configuration enabled

Turn → Code **3**, display: ***OFF***

Press , Code ***3*** blinks.
Change the setting of Code ***3***.

Turn → ***ON***

Press , display:
The configuration is enabled.

You can now configure codes one after the other:

Turn and select the required code.

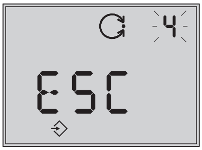
Press to access the selected code. The code number starts to blink.

Turn and select the setting.

Press to confirm the selected setting.

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid and the display changes to Code **0**.*

Cancel the setting:



Canceling the setting

To cancel a value before it is confirmed (by pressing) proceed as follows:

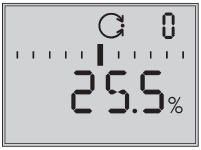
Turn → ***ESC***

Press . The entered value is not adopted.

8.2 Operating modes

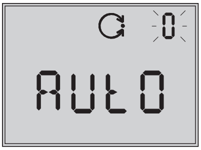
8.2.1 Automatic and manual modes

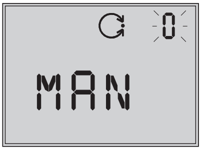
After initialization has been completed successfully, the positioner is in automatic mode.



automatic mode

Switch to manual operating mode





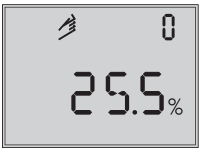
Turn → Code **0**

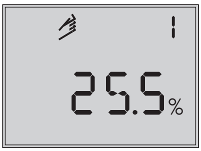
Press , display: ***AUtO***,
Code ***0*** blinks.

Turn → ***MAN***

Press to switchover to manual mode. The switchover is smooth since the manual mode starts up with the set point last used during automatic mode. The current position is displayed in %.

Adjust the manual reference variable





Turn → Code **1**

Press , Code ***1*** blinks.

Turn until sufficient pressure has been built up in the positioner and the control valve moves to the required position.

Note: *The positioner automatically returns to manual mode with Code* ***0*** *if no settings are made within 120 seconds.*

Switch to automatic operating mode

Turn → Code **0**

Press , Code ***0*** blinks.

Turn → ***AUtO***

Press . The positioner changes to automatic operating mode

8.2.2 SAFE – Fail-safe position

If you want to move the valve to fail-safe position determined during start-up (see section 7.1), proceed as follows:



Turn → Code **0**

Press , display: current operating mode (***AUtO*** or ***MAN)***, Code ***0*** blinks.

Turn → ***SAFE***

Press , display: ***S***.
The valve moves to the fail-safe position. Once the positioner is initialized, the current valve position is indicated on the digital display in %.

Exit the fail-safe position

Turn → Code ***0***

Press , Code ***0*** blinks.

Turn ⊛ and select the required operating mode ***AUtO*** or ***MAN***.

Press ⊛. The positioner switches to the operating mode selected.

8.3 Malfunction/maintenance alarm

All status and fault alarms are assigned to a classified status in the positioner. The default settings of the status classification are listed in the code list.

Note: *The status classification can be changed in the TROVIS-VIEW operator interface, over the parameters in the DD file or over the FF parameter.*

To provide a better overview, the classified alarms are summarized in a condensed state. The following status alarms are available:

- **Maintenance alarm**
  The positioner cannot perform its control task due to a functional fault in the device or in one of its peripherals or an initialization has not yet been successfully completed.
- **Maintenance required**
  The positioner still performs its control task (with restrictions). A maintenance requirement or above average wear has been determined. The wear tolerance will soon be exhausted or is reducing at a faster rate than expected. Maintenance is necessary in the medium term.
- **Maintenance demanded**
  The positioner still performs its control task (with restrictions). A maintenance demand or above average wear has been determined. The wear tolerance will soon be exhausted or is reducing at a faster rate than expected. Maintenance is necessary in the short term.
- **Function check**
  Test or calibration procedures are being performed. The positioner is temporarily unable to perform its control task until this procedure is completed.

Note: *If an event is assigned to the "No message" status, this event does not have any effect on the condensed state.*

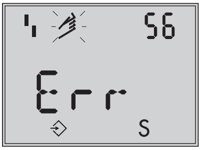
The condensed state appears on the display with the following icons:

Condensed state	Positioner display
Maintenance alarm	╹╻
Maintenance required/ Maintenance demanded	🔧
Function check	***tESting, TunE*** or ***tESt***

If the positioner has not been initialized, the maintenance alarm icon (╹╻) appears on the display as the positioner cannot follow its reference variable.

If fault alarms exist, the possible source of error is displayed in Code **49** onwards. In this case, ***Err*** appears on the display.

The cause and recommended action are listed in the code list (section 17.1).



Example
Error caused by pin position

***Note:** The optional EXPERT$^+$ diagnostics generates additional diagnostic alarms which are included in the condensed status with their corresponding status classification. When a diagnostic alarm is issued by EXPERT$^+$, this is displayed by Code 79.*

8.3.1 Confirming error messages

Enable configuration:

***Note:** If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*

Turn ⊛ → Code ***3***

Press ⊛, Code ***3*** blinks

Turn ⊛ → ***ON***

Press ⊛, display: ⟐

Confirm error messages:

Turn ⊛ → Error code which you want to confirm.

Press ⊛ to confirm the error message.

9 Status and diagnostic alarms

The Type 3730-5 Positioner contains integrated diagnostics to generate classified status and diagnostic alarms.

There are two different types of on-board diagnostics available: the standard integrated diagnostics (EXPERT) and the optional extended EXPERT+ diagnostics.

Due to the numerous diagnostic functions provided, the positioner generates classified status alarms and diagnostic alarms.

9.1 Standard EXPERT diagnostics

The standard EXPERT diagnostics provides information about positioner states such as operating hours counter, process monitoring, number of zero calibrations and initializations, total valve travel, temperature, initialization diagnostics, zero/control loop errors, logging of the last 30 alarms, etc.

In addition, the standard EXPERT diagnostics generates diagnostic and status alarms which allow faults to be pinpointed quickly when a fault occurs. Besides being displayed on the positioner display, the classified alarms are also available over the device description (DD).

Alarms are classified in the following main groups:

- Status
- Operation
- Hardware
- Initialization
- Data memory
- Temperature

9.2 Extended EXPERT^{+} diagnostics

In addition to the standard EXPERT diagnostic features, the optional EXPERT+ extended diagnostics provides the following online and offline test functions which enable significant statements on the condition of the entire control valve.

Online test functions (monitoring functions)

- Data logger
- Histograms
- Cycle counter
- Valve end position trend
- y = f (x) diagram (drive signal)
- Hysteresis test

Offline test functions (manual functions)

- y = f (x) diagram over the entire valve travel range
- Hysteresis test over the entire valve travel range
- Static characteristic
- Step response test

The diagnostic tests are completely integrated in the positioner. The DD allows parameters to be entered and test results to be read. The graph format depends on the control system used.
Further status alarms are generated from the extensive information gained in the diagnostic tests of EXPERT+ which provide the user with information covering the whole control valve.
The required reference graphs are automatically plotted after initialization and saved in the positioner if EXPERT+ is activated.
The optional diagnostic functions provided by EXPERT+ can be selected when ordering the positioner. Additionally, it is possible to activate EXPERT+ at a later point in time in an existing positioner.
For this purpose, an activation code can be ordered, requiring the serial number of the positioner to be specified.

Note: *Details on extended EXPERT^{+} diagnostics can be found in the Operating Instructions EB 8388-5 EN available on the Internet at http://www.samson.de.*

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10 Adjusting the limit switch

The positioner version with an inductive limit switch has one adjustable tag (1) mounted on the shaft which operates the proximity switch (3).

For operation of the inductive limit switch, the corresponding switching amplifier (see section 5.2.1) must be connected to the output.

If the tag (1) is inside the field of the switch, the switch assumes a high resistance. If the tag is outside of the field, the switch assumes a low resistance.

Normally, the limit switch is adjusted such that it will provide a signal in both end positions of the valve. The switch, however, can also be adjusted to indicate intermediate valve positions.

The desired switching function, i.e. whether the output relay shall be picked up or released when the tag has entered the field, has to be determined, if necessary, at the switching amplifier.

Setting the switching point:

NOTICE
During adjustment or testing, the switching point must always be approached from mid-position (50 %).

To ensure safe switching under any ambient conditions, the switching point should be adjusted to a value of approx. 5 % before the mechanical stop (OPEN – CLOSED).

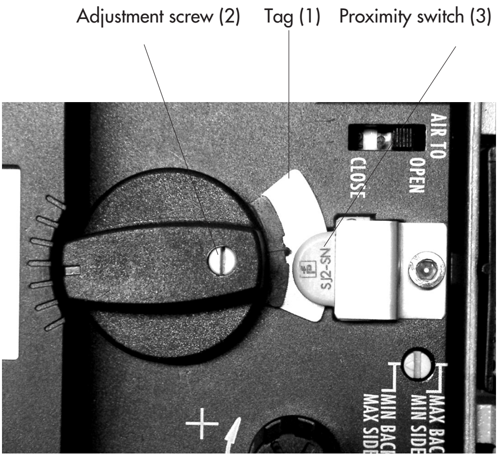


Fig. 22 · Adjustment of the limit switch

For CLOSED position:

1. Initialize positioner.
2. Use the ***MAN*** function to move the positioner to 5 % (see LC display).
3. Adjust the tag using the yellow adjustment screw (2) until the tag enters or leaves the field and the switching amplifier responds. You can measure the switching voltage as an indicator.

Contact function:
Tag leaving the field > contact is made.
Tag entering the field > contact is opened.

For OPEN position:

1. Initialize positioner.
2. Use the ***MAN*** function to move the positioner to 95 % (see LC display).
3. Adjust the tag (1) using the yellow adjustment screw (2) until the tag enters or leaves the field of the proximity switch (3).
   You can measure the switching voltage as an indicator.

Contact function:

Tag leaving the field > Contact is made.
Tag entering the field > Contact is opened.

11 Retrofitting an inductive limit switch

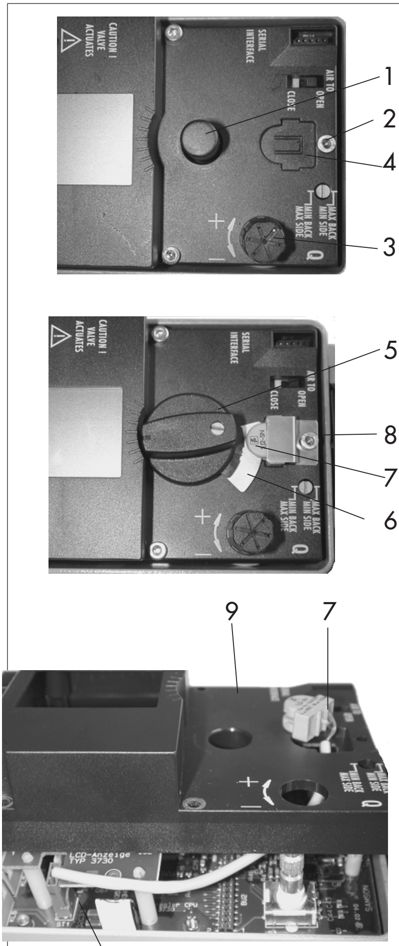
Required retrofit kit:
Limit switch Order no. 1400-7460

Note: *The same requirements apply to retrofitting an inductive limit switch as to servicing the positioner. For explosion-protected devices, the requirements in section 13 need to be kept.*
Check the "Limit switch, inductive" box on the nameplate after retrofitting the limit switch.

1. Take off the rotary pushbutton (3) and cap (1), unthread the five fixing screws (2) and lift off the plastic cover (9) together with the display, **taking care not to damage the ribbon cable (between PCB and display)**.
2. Use a knife to cut an opening at the marked location (4).
3. Push the connector (11) with cable through the opening and secure the proximity switch (7) on the cover with a dot of glue.
4. Remove the jumper (8801-2267) at the socket X7 of the top board and insert the cable connector (11).
5. Guide the cable in such a manner that the plastic cover can be placed back onto the positioner. Insert the fixing screws (2) and screw tight. Attach the clamping plate (8) onto the proximity switch.
6. Attach the rotary switch (5). Make sure the flattened side of the positioner shaft

is turned so that the rotary switch (5) can be attached with the metal tag next to the proximity switch.

7. **Note:** On start-up of the positioner, set the option "inductive alarm" under Code ***38*** from ***NO*** to ***YES***.



1 Cap
2 Screws
3 Rotary pushbutton
4 Marking
5 Rotary switch
6 Metal tag
7 Proximity switch
8 Clamping plate
9 Plastic cover
11 Connector

Fig. 23 · Retrofitting an inductive limit switch

12 Maintenance

The positioner does not require any maintenance.

There are filters with a 100 μm mesh size in the pneumatic connections for supply and output which can be removed and cleaned, if required.

The maintenance instructions of any upstream supply air pressure reducing stations must be observed.

13 Servicing explosion-protected devices

If a part of the device on which the explosion protection is based needs to be serviced, the device must not be put back into operation until a qualified inspector has assessed it according to explosion protection requirements, has issued an inspection certificate or given the device a mark of conformity.

Inspection by a qualified inspector is not required if the manufacturer performs a routine test on the device prior to putting it back into operation. The passing of the routine test must be documented by attaching a mark of conformity to the device. Replace explosion-protected components only by original, routine-tested components from the manufacturer.

Devices that have already been operated outside hazardous areas and are intended for future use inside hazardous areas must comply with the safety requirements placed on serviced devices. Before being used inside hazardous areas, test the devices according to the specifications for servicing explosion-protected devices.

Read section 15 for maintenance, calibration and adjustment work inside and outside hazardous areas.

14 Firmware update (serial interface)

Firmware updates on positioners currently in operation can be performed as follows:

When updates are performed by a service employee appointed by SAMSON, the update is confirmed on the positioner by the test mark assigned by SAMSON's Quality Assurance.

In all other cases, only persons from the plant operator with written approval may perform updates. This person must confirm the update on the positioner.

Laptops and PCs connected to the power supply must use an additional safety barrier.

This does not apply to laptops in battery operation. In this case, it is assumed that a battery-powered laptop runs briefly for software programming or for testing purposes.

a) **Updates outside the hazardous area:**

   Remove the positioners from the plant and update them outside the hazardous area.

b) Updates on site:

Updates on site are only permitted after the plant operator has presented a signed hot work permit.

After updating has been completed, add the current firmware to the nameplate; this can be done using labels.

15 Maintenance, calibration and work on equipment

The interconnection with intrinsically safe circuits to check or calibrate the apparatus must only be performed with intrinsically safe current/voltage calibrators and measuring instruments to rule out any damage to components relevant for explosion protection.

The maximum values for intrinsically safe circuits specified in the approvals must be kept.

16 Fieldbus specification

These instructions are based on the following:

- Fieldbus Foundation Specification "Function Block Application Process Part 1 to 3" Revision 1.5.
- Fieldbus Foundation Specification "Transducer Block Application Process Part 1 to 2" Revision PS 3.0.

16.1 Device description (DD)

The following device description files are needed to integrate the device described into the host system:

Device Description: < 0101.ffo >, < 0101.sym > Capabilities File: < 010101.cff >

These device description files can be downloaded from the Internet, for example, at www.fieldbus.org or www.samson.de.

16.2 FOUNDATION™ fieldbus block model

FOUNDATION™ fieldbus assigns all the functions and data of a device to three different types of blocks. Each type of block has a different range of tasks to fulfill in the block model. The following types of blocks are implemented in the SAMSON Type 3730-5 Positioner:

- **One Resource Block**
  The Resource Block contains all the specific characteristics associated with a device on the Fieldbus, for example, device name, manufacturer number and serial number.
  A device can only have one Resource Block.
- **One AO Transducer Block**
  Each AI or AO Function Block has a Transducer Block which contains all data and device-specific parameters to connect the device to the process value (sensor or final control element). The positioner output signal can be directly influenced over the AO Transducer Block.
- **Two DI Transducer Blocks**
  The DI Transducer Blocks connect binary input signals for transmission and processing over the fieldbus.
- **One Analog Output Function Block**
  Function blocks are responsible for the control behavior of a FOUNDATION™ fieldbus device. A FOUNDATION™ fieldbus application can be configured by connecting the inputs and outputs of function blocks.

The AO Function Block converts the output value from an upstream function block into a control value for the valve.
Execution time: 20 ms

- **Two Discrete Input Function Blocks**
  The DI Function Blocks are used as inputs to control binary signals. They support the selection of binary switching conditions of various functions.
  Execution time: 40 ms
- **One PID Function Block**
  The PID controller has a flexible proportional-integral-differential control algorithm which can be configured as required to match the application.
  Execution time: 60 ms

16.3 Resetting the device

The positioner can be reset in various ways in accordance with the FF specification.

RESTART (16) parameter in the Resource Block:

- DEFAULTS:
  The device data and the link are reset to the values as defined in the FF specification.
- PROCESSOR:
  Warm start of the positioner, restart of the processor.

16.4 Status classification and condensed state

The status alarms are classified in the positioner, i.e. when an alarm is issued, it is assigned a status. The classification of the states can be changed over the following FF parameters in the AO Transducer Block:

- ERROR_OPTION_INIT_FAILURE (36):
  Masking of the initialization error
- ERROR_OPTION_OPERATION_FAILURE (37):
  Masking of the operational error
- ERROR_OPTION_HW_FAILURE (38):
  Masking of the hardware error
- ERROR_OPTION_DATA_FAILURE (39):
  Masking of the data error
- ERROR_OPTION_ENH_DIAGNOSTIC (40 to 44):
  Masking of the status and fault alarms generated by the diagnostics

To provide a better overview, the classified alarms are summarized in a condensed state (CONDENSED_STATE (59) in RES Block). Besides the CONDENSED_STATE parameter, the condensed state can be issued to the discrete output OUT_D of the DI Function Blocks.

Possible states of the condensed state include:

0	ok	
1	Maintenance required	The positioner still performs its control task (with restrictions). A maintenance requirement or above average wear has been determined. The wear tolerance will soon be exhausted or is reducing at a faster rate than expected. Maintenance is necessary in the medium term.
2	Maintenance demanded	The positioner still performs its control task (with restrictions). A maintenance demand or above average wear has been determined. The wear tolerance will soon be exhausted or is reducing at a faster rate than expected. Maintenance is necessary in the short term.
3	Maintenance alarm	The positioner cannot perform its control task due to a functional fault in the device or in one of its peripherals or an initialization has not yet been successfully completed.
7	Function check	Test or calibration procedures are being performed. The positioner is temporarily unable to perform its control task until this procedure is completed.

In addition to the condensed status, the block error alarms (BLOCK_ERR) from the Resource Block and Transducer Block can also be assigned to the events.
In this case, the individual alarms must be classified in the ERROR_OPTION_… (Index 36 to 44) parameter with another status for block errors.
The following classifications are possible:

- No message
- Maintenance soon
- Maintenance now

The block error (BLOCK_ERR) results from the summary of classified alarms that are active.

17 Appendix

17.1 Code list

Code no.	**Parameter** – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
0	**Operating mode** [MAN] Manual mode AUtO Automatic mode SAFE Fail-safe position ESC Escape	Switchover from automatic to manual mode is smooth. In fail-safe mode, the symbol **S** appears on the display. In MAN and AUtO mode, the system deviation is represented by the bar graph elements. When the positioner is initialized, the numerical display indicates the valve position or the angle of rotation in %, otherwise the position of the lever in relation to the central axis is displayed in degrees °.
1	**Manual w** 0 to 100 [0] % of the nominal range	Adjust the manual set point with the rotary pushbutton, the current travel/angle is displayed in % when the positioner is initialized, otherwise the position of the lever in relation to the central axis is indicated in degrees °. ***Note:*** *Can only be selected when Code **0** = MAN*
2	**Reading direction** [Normal] or upside down ESC	The reading direction of the display is turned by 180°.
3	**Enable configuration** [OFF] ON ESC	Enables the option to modify data (automatically deactivated when the rotary pushbutton has not been operated for 120 s.) ***FF*** blinks on the display when the on-site operation is locked. Codes marked with an asterisk (*) can only be read and not overwritten. Likewise, codes can only read over the SSP interface.

Code no.	**Parameter** – Display, values [default setting]	**Description**
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
4*	**Pin position** 17, 25, 35, 50, 70, 100, 200 mm 90° with rotary actuators [OFF], ESC **Note!** If you select a pin position in Code **4** that is too small, the positioner switches to SAFE mode for reasons of safety	The follower pin must be inserted into the correct pin position according to the valve travel/angle of rotation. For initialization using NOM or SUb, this pin position must be entered. Pin position Code **4** – Standard Code **5** – Adjustment range Code **5** **17** – 7.5 – 3.6 to 17.7 **25** – 7.5 – 5.0 to 25.0 **35** – 15.0 – 7.0 to 35.4 **50** – 30.0 – 10.0 to 50.0 **70** – 40.0 – 14.0 to 70.7 **100** – 60.0 – 20.0 to 100.0 **200** – 120.0 – 40.0 to 200.0 **90°** – 90.0 – 24.0 to 100.0
5*	**Nominal range** mm or angle ° ESC	For initialization using NOM or SUb, the nominal travel/angle of rotation of the valve must be entered. The permissible adjustment range depends on the pin position according to the table for Code 4. Code **5** is generally locked until Code **4** is set to OFF, i.e. after a pin position has been entered, Code **5** can be configured. After initialization has been successfully completed, the maximum nominal travel/angle reached on initialization is displayed.
6*	**Init mode** [MAX] NOM MAN SUb ZP ESC	Select the initialization mode MAX: Travel/angle of the closure member from the CLOSED position to the opposite stop in the actuator. NOM: Travel/angle of the closure member measured from the CLOSED position to the indicated OPEN position. MAN: Manually selected range SUb: Substitute calibration (without initialization) ZP: Zero calibration

Code no.	Parameter – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
7*	**w/x** [↗↗] increasing/increasing ↗↘ increasing/decreasing ESC	Direction of action of the reference variable w in relation to the travel/angle of rotation x Automatic adaptation: AIR TO OPEN: On completing initialization, the direction of action remains increasing/increasing (↗↗), a globe valve opens as the mA signal increases. AIR TO CLOSE: On completing initialization, the direction of action changes to increasing/decreasing (↗↘), a globe valve closes as the mA signal increases.
8*	**Travel/angle range start (lower x-range value)** 0.0 to 80.0 [0.0] % of the nominal range ESC **Note!** Specified in mm or angle ° provided Code **4** is set	Lower range value for the travel/angle of rotation in the nominal or operating range. The **operating range** is the actual travel/angle of the control valve and is limited by the lower x-range value (Code **8**) and the upper x-range value (Code **9**). Usually, the operating range and the nominal range are identical. The nominal range can be limited to the operating range by the lower and upper x-range values. Value is displayed or must be entered. The characteristic is adapted. See also the example in Code **9**!
9*	**Travel/angle range end (upper x-range value)** 20.0 to 100.0 [100.0] % of the nominal range ESC **Note!** Specified in mm or angle ° provided Code **4** is set	Upper range value for the travel/angle of rotation in the nominal or operating range. Value is displayed or must be entered. The characteristic is adapted. **Example:** The operating range is modified, for example, to limit the range of a control valve which has been sized too large. For this function, the entire resolution range of the reference variable is converted to the new limits. 0 % on the display corresponds to the adjusted lower limit and 100 % to the adjusted upper limit.
10*	**Travel/angle lower limit (lower x-limit)** 0.0 to 49.9 % of the operating range [OFF], ESC	Limitation of the travel/angle of rotation downwards to the entered value, the characteristic is not adapted. The characteristic is not adapted to the reduced range. See also example in Code **11**.

Code no.	**Parameter** – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
11*	**Travel/angle upper limit (upper x-limit)** 50.0 to 120.0 [100] % of the operating range OFF, ESC	Limitation of the travel/angle of rotation upwards to the entered value, the characteristic is not adapted. **Example:** In some applications, it is better to limit the valve travel, e.g. if a certain minimum medium flow is required or a maximum flow must not be reached. The lower limit must be adjusted with Code **10**, and the upper limit with Code **11**. If a tight-closing function has been set up, it has priority over the travel limitation! When set to OFF, the valve can be opened past the nominal travel with a reference variable outside of the 0 to 100 % range.
14*	**Reference variable range start** (w-start) 0.0 to 49.9 [1.0] % of the span adjusted via Code **12/13** OFF, ESC	If w approaches the percentage adjusted at the final value that causes the valve to close, the actuator is immediately completely vented (with AIR TO OPEN) or filled with air (with AIR TO CLOSE). This action always lead to maximum tight-closing of the valve. Codes **14/15** have priority over Codes **8/9/10/11**. Codes **21/22** have priority over Codes **14/15**.
15*	**Reference variable range end** (w-end) 50.0 to 100.0 % of the span adjusted via Code **12/13** [OFF], ESC	If w approaches the percentage adjusted at the final value that causes the valve to open, the actuator is immediately completely filled with air (with AIR TO OPEN) or vented (with AIR TO CLOSE). This action always lead to the valve being completely opened. Codes **14/15** have priority over Codes **8/9/10/11**. Codes **21/22** have priority over Codes **14/15**. Example: Set the final position w > to 99 % for three-way valves.
16*	**Pressure limit** 1.4 2.4 3.7 bar [OFF], ESC	The signal pressure to the actuator can be limited in stages. After changing a pressure limit already set, the actuator must be vented once (e.g. by selecting the fail-safe position (SAFE) over Code **0**). ***NOTICE*** *Do not activate the pressure limit for double-acting actuators with valve closed position AIR TO OPEN (AtO).*

Code no.	Parameter – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
17*	**Proportional-action coefficient KP (step)** 0 to 17 [7] ESC	Displaying or changing K_P **Note on changing the K_P and T_V steps:** During the initialization of the positioner, the K_P and T_V values are optimized. Should the positioner show a tendency for impermissibly high post-pulse oscillation due to additional interference, the K_P and T_V steps can be adapted after the initialization. For this, either the T_V step can be increased in increments until the desired response behavior is reached or, when the maximum value of 4 is reached, the K_P step can be decreased in increments. **NOTICE** Changing the K_P step influences the system deviation.
18*	**Rate time TV (step)** 1 [2] 3 4 OFF OFF, ESC	Displaying or changing T_V, see note under K_P step A change of the T_V step has no effect on the system deviation.
19*	**Tolerance band** 0.1 to 10.0 [5] % of the operating range ESC	Used for error monitoring Determination of the tolerance band in relation to the operating range. Associated lag time [30] s is a reset criterion. If a transit time is determined during initialization which is six times > 30 s, the six-fold transit time is accepted as the lag time.

Code no.	**Parameter** – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
20*	**Characteristic** 0 to 9 [0] ESC	Select the characteristic: 0 Linear 1 Equal percentage 2 Reverse equal percentage 3 SAMSON butterfly valve linear 4 SAMSON butterfly valve equal percentage 5 VETEC rotary plug valve linear 6 VETEC rotary plug valve equal percentage 7 Segmented ball valve linear 8 Segmented ball valve equal percentage 9 User-defined (defined over operating software) ***Note:*** The various characteristics are listed in the Appendix (section 19).
21*	**Required transit time OPEN (w ramp open)** 0 to 240 s [0] ESC	The time required to pass through the operating range when the valve opens. Limitation of the transit time (Code **21** and **22**): For some applications it is recommendable to limit the transit time of the actuator to prevent it from engaging too fast in the running process. Code **21** has priority over Code **15**. **NOTICE** The function is not activated when the fail-safe function or solenoid valve is triggered nor upon failure of the auxiliary power.
22*	**Required transit time CLOSED (w ramp closed)** [0] to 240 s ESC	The time required to pass through the operating range when the valve closes. Code **22** has priority over Code **14**. **NOTICE** The function is not activated when the fail-safe function or solenoid valve is triggered nor upon failure of the auxiliary power.
23*	**Total valve travel** 0 to $99 \cdot 10^7$ [0] Exponential reading from 9999 travel cycles onwards RES, ESC	Totaled double valve travel. Can be reset to 0 via *RES*. **Note:** The total valve travel is saved in a non-volatile memory after every 1000 double travel.

Code no.	**Parameter** – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
24*	**LV total valve travel** 1000 to 99 · 10^7 [1 000 000] Exponential reading from 9999 travel cycles onwards ESC	Limit value of total valve travel. If the limit is exceeded, the fault symbol and the wrench symbol corresponding with the collective status appear.
34*	**Closing direction** CL Clockwise [CCL] Counterclockwise ESC	Turning direction in which the valve is moved to the CLOSED position (view onto the rotary switch motion when the positioner cover is open). Needs only be entered in initialization mode *SUb* (Code **6**).
35*	**Blocking position** [0] mm/° /% ESC	Entering the blocking position. Distance up to the CLOSED position. Only necessary in initialization mode *SUb*.
36*	**Reset** [OFF], RUN, ESC	Resets all start-up parameters to default (factory setting). Does not apply to block configuration. **Note:** After setting ***RUN***, the positioner must be re-initialized.
38*	**Inductive alarm** [NO], YES, ESC	Indicates whether the inductive limit switch option is installed or not.
39	**System deviation e info** –99.9 to 999.9 %	Display only, indicates the deviation from the position required.
40	**Transit time Open info** 0 to 240 s [0]	Display only, minimum opening time determined during initialization.
41	**Transit time Closed info** 0 to 240 s [0]	Display only, minimum closing time determined during initialization.
42	**Auto-w/manual-w info** 0.0 to 100.0 % of the span	Display only, Auto mode: indicates the supplied automatic reference variable Man mode: indicates the supplied manual reference variable
43	**Firmware info** control	Display only, indicates the positioner type and current firmware version in alternating sequence.

Code no.	Parameter – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
44	**y info** [0] to 100 % 0P, MAX, – – –	Display only. Indicates the control signal y in % based on the travel range determined on initialization MAX: The positioner builds up its maximum output pressure, see description in Code **14** and **15**. 0P: The positioner vents completely, see description in Code **14** and **15**. – – –: The positioner is not initialized.
45	**Solenoid valve info** YES, HIGH/LOW, NO	Display only, indicates whether a solenoid valve is installed or not. If a voltage supply is connected at the terminals of the installed solenoid valve, *YES* and *HIGH* appear on the display in alternating sequence. If a voltage supply is not connected (actuator vented, fail-safe position indicated on the display by the **S** icon), *YES* and *LOW* appear on the display in alternating sequence.
46*	**Bus address** ESC	Select bus address 16 to 247 . . . . Positioners with fixed bus address 248 to 251 Positioners without fixed bus address (new or . . . . . . decommissioned positioners)
47*	**Write protection FF** YES, [NO], ESC	When the write protection function is activated, device data can only be read, but not overwritten over FF communication.
48*	**Diagnostic parameters d**	
	d0 Current temperature –55 to 125	Operating temperature [°C] inside the positioner
	d1 Minimum temperature [20]	The lowest temperature below 20 °C that has ever occurred.
	d2 Maximum temperature [20]	The highest temperature above 20 °C that has ever occurred.
	d3 Number of zero calibrations	The number of zero calibrations since the last initialization.
	d4 Number of initializations	The number of initializations that have been performed.
	d5 Zero point limit 0.0 to 100.0 % [5 %]	Limit for the zero point monitoring.

Code no.	Parameter – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
48*	**d6** Condensed status	Condensed status, made up from the individual states. 0 OK: Okay 1 C: Maintenance required 2 CR: Maintenance demanded 3 B: Maintenance alarm 7 I: Function check
	d7 Start reference run [OFF], ON, ESC, 1	Triggering of a reference run for the functions: Drive signal y steady-state and drive signal y hysteresis. The reference run can only be activated in manual operating mode as the valve moves through its entire travel range. If EXPERT+ is activated at later point in time, the reference graphs must be plotted in order to activate the diagnostic functions.
	d8 EXPERT+ activation	Enter the activation code for EXPERT+. After the activation procedure has been successfully completed, ***YES*** appears under d8.
	FF parameters FF-P	
	F0 Firmware Rev. Communication	
	F1 Binary input 1	1 Active 0 Inactive
	F2 Binary input 2	1 Active 0 Inactive
	F3 Simulate	Activation of simulation mode
	F4 to F7	Unassigned
	AO Function Block A	
	A0 Target Mode	Required operating mode
	A1 Actual Mode	Actual operating mode
	A2 CAS_IN value	Display of the analog reference variable adopted from an upstream function block
	A3 CAS_IN status	and its status
	A4 SP value	Displays the set point (reference variable)
	A5 SP status	and its status
	A6 Out value	Displays the manipulated variable (output value)

Code no.	Parameter – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
48*	A7 Out status	and its status
	A8 Block error	Displays the current block error
	PID Function Block P	
	P0 Target Mode	Required operating mode
	P1 Actual Mode	Actual operating mode
	P2 CAS_IN value	Display of the analog reference variable adopted from an upstream function block
	P3 CAS_IN status	and its status
	P4 SP value	Displays the set point (reference variable)
	P5 SP status	and its status
	P6 Out value	Displays the manipulated variable (output value)
	P7 Out status	und its status
	P8 Block error	Displays the current block error
	Transducer Blocks A0, DI1, DI2 t	
	t0 Target Mode AO TRD	Required operating mode
	t1 Actual Mode AO TRD	Actual operating mode
	t2 Transducer state	State of the Transducer Block
	t3 Block error AO TRD	Displays the current block error
	t4 Target Mode DI1	Required operating mode
	t5 Actual Mode DI1 TRD	Actual operating mode
	t6 Block error DI1 TRD	Displays the current block error
	t7 Target Mode DI2 TRD	Required operating mode
	t8 Actual Mode DI2	Actual operating mode
	t9 Block error DI2	Displays the current block error
	Resource Block S	
	S0 Resource Target Mode	Required operating mode

Code no.	Parameter – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
48*	S1 Resource Actual Mode	Actual operating mode
	S2 Resource block error	Displays the current block error
	DI1Function Block I	
	I0 Target Mode DI1	Required operating mode
	I1 Actual Mode DI1	Actual operating mode
	I2 Field_Val_D value	Displays the discrete input variable and its status
	I3 Field_Val_D status	
	I4 OUT_D value	Displays the discrete output variable and its status
	I5 OUT_D status	
	I6 Block error	Displays the current block error
	D2 Function Block L	
	L0 Target Mode DI2	Required operating mode
	L1 Actual Mode DI2	Actual operating mode
	L2 Field_Val_D value	Displays the discrete input variable and its status
	L3 Field_Val_D status	
	L4 OUT_D value	Displays the discrete output variable and its status
	L5 OUT_D status	
	L6 Block error	Displays the current block error

Note: *The error codes listed in following appear in the display corresponding to their status classification set over the condensed state (Maintenance required/Maintenance demanded: 🔧, Maintenance alarm: ⊥). If "No message" is assigned to the error code as the status classification, the error is not included in the condensed state.*
A status classification is assigned to every error code in the default setting. The status classification of error codes can also be changed as required using an operating software (e.g. TROVIS-VIEW).

Initialization errors

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
50	**x > range**	The value supplied by the measuring signal is either too high or too low, the measuring sensor is close to its mechanical limit. • Pin positioned incorrectly. • Bracket slipped in case of NAMUR attachment or positioner is not central. • Follower plate incorrectly attached.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and pin position, set operating mode from SAFE to MAN and re-initialize the positioner.
51	**Δx < range**	The measuring span of the sensor is too low. • Pin positioned incorrectly. • Wrong lever. A rotational angle smaller than 16° at the positioner shaft creates just an alarm. An angle below 9° leads to the initialization being canceled.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and re-initialize the positioner.
52	**Attachment**	• Positioner attachment incorrect. • Nominal travel/angle (Code **5**) could not be achieved during initialization under NOM (no tolerance downwards permissible). • Mechanical or pneumatic fault, e.g. wrong lever selected or supply pressure too low to move to the required position.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and supply pressure. Re-initialize the positioner. Under certain circumstances, it may be possible to check the maximum travel/angle by entering the actual pin position and then performing an initialization under MAX. After initialization has been completed, the Code **5** indicates the maximum achieved travel or angle.

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
53	**Initialization time exceeded (Init time >)**	The initialization routine lasts too long. • No pressure on the supply line or there is a leak. • Supply air failure during initialization.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and supply pressure. Re-initialize the positioner.
54	**Initialization - solenoid valve**	1) A solenoid valve is installed (Code **45** = YES) and was not or not properly connected so that an actuator pressure could not be built up. The alarm is generated when you attempt to initialize the positioner. 2) If you attempt to initialize the device from the fail-safe position (SAFE).
	Status classification	[Maintenance required]
	Recommended action	Re. 1) Check connection and supply voltage of the forced venting Code **45** HIGH/LOW Re. 2) Set the ***MAN*** operating mode over Code **0**. Then initialize the positioner.
55	**Transit time too short (transit time <)**	The actuator positioning rates determined during the initialization are so short that the positioner cannot adapt itself optimally.
	Status classification	[Maintenance required]
	Recommended action	Check the volume restriction setting as described in section 7.2, re-initialize the positioner.
56	**Pin position**	Initialization was canceled because you are required to enter the pin position for the selected initialization modes ***NOM*** and ***SUb***.
	Status classification	[Maintenance required]
	Recommended action	Enter pin position over Code **4** and nominal travel/angle over Code **5**. Re-initialize the positioner.

Operational errors

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
57	**Control loop**	Control loop error, the control valve does not react within the tolerable times of the controlled variable (tolerance band alarm Code **19**). • Actuator mechanically blocked. • Attachment of the positioner subsequently shifted. • Supply pressure not sufficient.
	Status classification	[Maintenance required]
	Recommended action	Check attachment.
58	**Zero point**	Zero point incorrect. Error may arise when the mounting position/linkage of the positioner moves or when the valve seat trim is worn, especially with soft-sealed plugs.
	Status classification	[Maintenance required]
	Recommended action	Check valve and mounting of the positioner. If OK, perform a zero calibration over Code **6** (see section 7.7 on page 62). If the lever position on the back of the positioner has been changed (e.g. while exchanging the lever), move the lever as far as it will go in both directions to adapt it to the internal measuring lever.
59	**Autocorrection**	Should an error occur in the data range of the positioner, the self-monitoring function recognizes it and automatically corrects it.
	Status classification	[No message]
	Recommended action	Automatic
60	**Fatal error**	An error was detected in the data relevant for safety, autocorrection is not possible. This may be due to EMC disturbances. The positioner changes to the fail-safe position (SAFE).
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Reset over Code **36**. Re-initialize the positioner.

Hardware errors

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
62	**x signal**	Determination of the measured data for the actuator has failed. Conductive plastic element is defective. The positioner continues to run in emergency mode, but should be replaced as soon as possible. The emergency mode on the display is indicated by a blinking closed-loop operation icon and 4 dashes instead of the position indication. **Note on the closed-loop operation:** If the measuring system has failed, the positioner is still in a reliable state. The positioner switches to emergency mode where the position cannot be accurately controlled anymore. However, the positioner continues operation according to its reference variable signal so that the process remains in a safe state.
	Status classification	[Maintenance demanded]
	Recommended action	Return the positioner to SAMSON AG for repair.
64	**i/p converter**	The circuit of the i/p converter has been interrupted.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Cannot be remedied. Return the positioner to SAMSON AG for repair.
65	**Hardware**	A hardware error has occurred, the positioner changes to the fail-safe position (SAFE).
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Confirm error and return to the automatic operating mode, or perform a reset and re-initialize the device. If this is not successful, return device to SAMSON AG for repair.
66	**Data memory**	The writing of data to the data memory does not work anymore, e.g. when the written data deviate from the read data. Valve moves to the fail-safe position.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Return the positioner to SAMSON AG for repair.

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
67	**Test calculation**	The hardware controller is monitored by means of a test calculation.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Confirm error. If this is not possible, return the positioner to SAMSON AG for repair.

Data errors

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
68	**Control parameter**	Control parameter error
	Status classification	[Maintenance required]
	Recommended action	Confirm error, perform reset and re-initialize the positioner.
69	**Poti parameter**	Parameter error of the digital potentiometer.
	Status classification	[Maintenance required]
	Recommended action	Confirm error, perform reset and re-initialize the positioner.
70	**Calibration parameter**	Error in the production calibration data. Subsequently, the device runs on default values.
	Status classification	[Maintenance required]
	Recommended action	Return the positioner to SAMSON AG for repair.
71	**General parameters**	Parameter errors that are not critical for the control.
	Status classification	[Maintenance required]
	Recommended action	Confirm error. Check and, if necessary, reset required parameters.
73	**Internal device error 1**	Internal device error
	Status classification	[Maintenance required]
	Recommended action	Return the positioner to SAMSON AG for repair.
74	**FF parameters**	Parameter errors that are not critical for the control.
	Status classification	[Maintenance required]
	Recommended action	Confirm error and perform reset.

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
76	**No emergency mode**	The travel measuring system of the positioner has a self-monitoring function (see Code **62**). An emergency mode (open-loop control) is not available for certain actuators, such as double-acting actuators. In this case, the positioner changes to the fail-safe position (SAFE) when a measuring error occurs. During the initialization, the positioner checks whether the actuator has such a function or not.
	Status classification	[No message]
	Recommended action	Merely information, confirm, if necessary. No further action necessary.
77	**Program loading error**	When the positioner starts operation for the first time after the input signal has been applied, it carries out a self-test (***tEStinG*** runs across the display). If the positioner loads the wrong program, the valve moves to the fail-safe position. It is not possible to make the valve leave this fail-safe position again.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Interrupt current and restart positioner. Otherwise, return the positioner to SAMSON AG for repair.
78	**Options parameter**	Errors in options parameters
	Status classification	[Maintenance required]
	Recommended action	Return the positioner to SAMSON AG for repair.

Diagnosis errors

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
79	**Diagnostic alarms**	Alarms are generated by the extended EXPERT+ diagnostics if EXPERT+ has been activated under Code **48**
	Status classification	Maintenance required (cannot be classified)
80	**Diagnostic parameters**	Errors that are not critical for control.
	Status classification	Maintenance required (cannot be classified)
81	**Reference graphs**	An error occurred during plotting the reference graphs for drive signal y steady-state or drive signal y hysteresis. • Reference test was interrupted • Reference line for drive signal y steady-state or drive signal y hysteresis was not adopted.
	Status classification	[No message]
	Recommended action	Check and, if necessary, perform a new reference test

17.2 Parameters

Several parameters can only be modified in certain modes (see Read/write capability in the parameter description). In this case, not the actual mode is decisive, but the target mode.

17.2.1 Resource Block

The Resource Block contains all the data that identify the device. It is similar to an electronic device tag.

Resource Block parameters include device type, device name, manufacturer ID, serial number as well as parameters which affect the behavior of all other blocks of the device.

Refer to page 108 for the list of parameters.

All time specifications in the Resource Block are specified in the unit of 1/32 ms according to the Fieldbus Specification Version 1.5.
In the Device Description Library supplied by Fieldbus Foundation upon which the device description of 3730-5 is also based, these parameters are incorrectly specified as the unit of ms. The specified values supplied by the device are, however, always to be interpreted as the unit of 1/32 ms.

17.2.2 Analog Output Transducer Block

The Transducer Block allows the input and output variables of a function block to be influenced. In this way, process data can be used to calibrate measured and control data, linearize characteristics, or convert engineering units. Transducer Block parameters include information on the type of actuator, attachment, engineering units, commissioning, diagnostics as well as device-specific parameters.

The Standard Advanced Positioner Valve Transducer Block receives an output value from an upstream Analog Output Function Block. This value is used to position a control valve. The block contains parameters to adapt the positioner to the actuator and valve as well as for valve commissioning and diagnostics.

Refer to page 118 for the list of parameters.

17.2.3 Discrete Input Transducer Blocks

Discrete Input Transducer Blocks directly connect the physical inputs of the field device to the assigned function blocks.
The CHANNEL parameter is used to assign the Transducer Blocks to the function blocks.
The Type 3730-5 Positioner has two binary inputs that work independently from one another. A Discrete Input Function Block exists for each input.

The DI Transducer Blocks are implemented according to the FF Specification and do not contain any manufacturer-specific parameters.

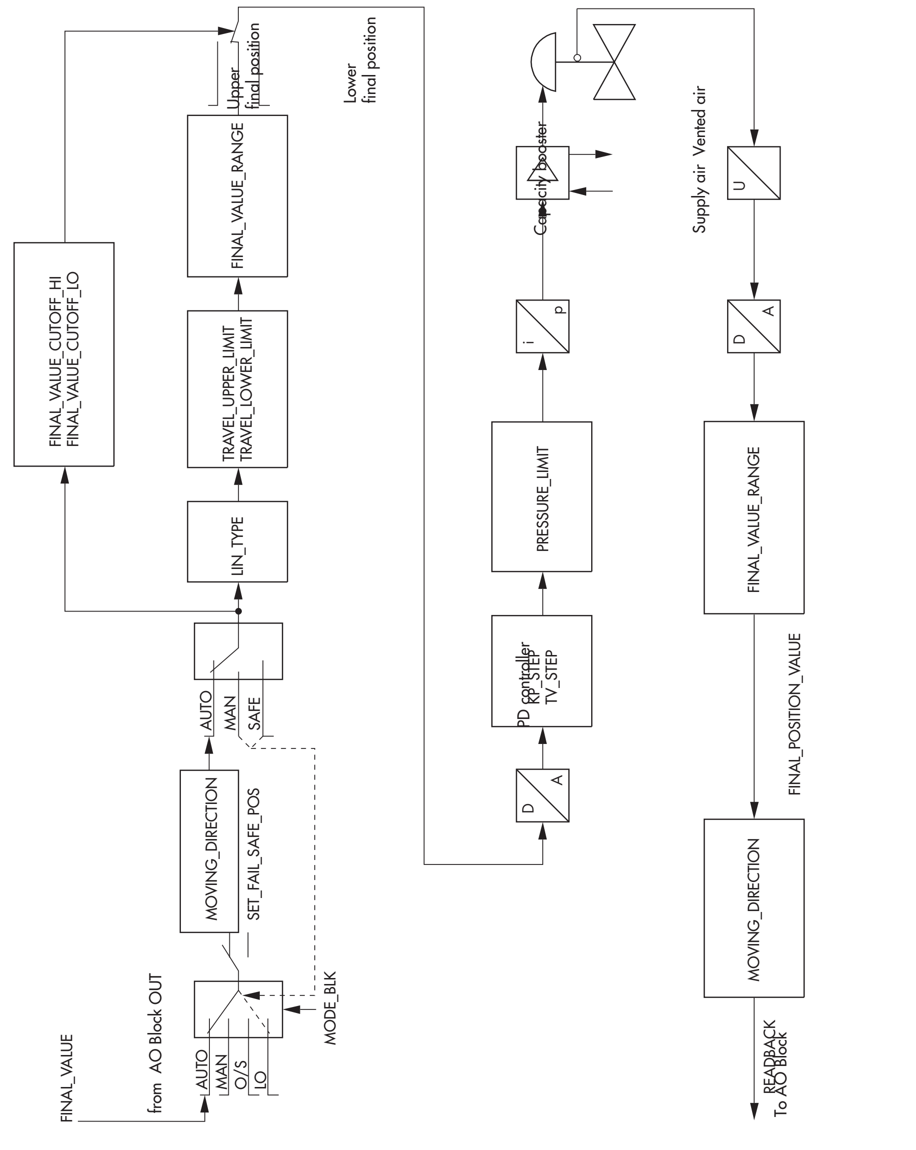


Fig. 24 · Analog Output Transducer Block

17.2.4 Analog Output Function Block

The Analog Output Function Block processes an analog signal from an upstream function block (e.g. PID Block) into an output value intended for the downstream Transducer Block (e.g. valve positioner). It contains scaling functions and ramp functions as well as other functions.
The AO Block receives its set point depending on the mode (MODE_BLK) from one of the input variables CAS_IN, RCAS_IN or SP. An internal working set point is created from it, taking into account the PV_SCALE, SP_HI_LIM and SP_LO_LIM, SP_RATE_UP and SP_RATE_DN. Depending on the IO_OPTS and XD_SCALE parameters, an output value OUT is generated which is passed on to the downstream Transducer Block over the CHANNEL parameter.
A Fault State is included in the AO Block which is activated when a fault condition (of the valid set point) last longer than the time determined in FSTATE_TIME or when SET_FSTATE is activated in the Resource Block.
The Fault State is determined over FSTATE_TIME, FSTATE_VAL and IO_OPTS parameters.

In the Device Description Library supplied by Fieldbus Foundation upon which the device description of 3730-5 is also based, "Fault state to value" is indicated as "Fault state type" in the IO_OPTS parameter of the AO Function Block.

Refer to page 142 for the list of parameters.

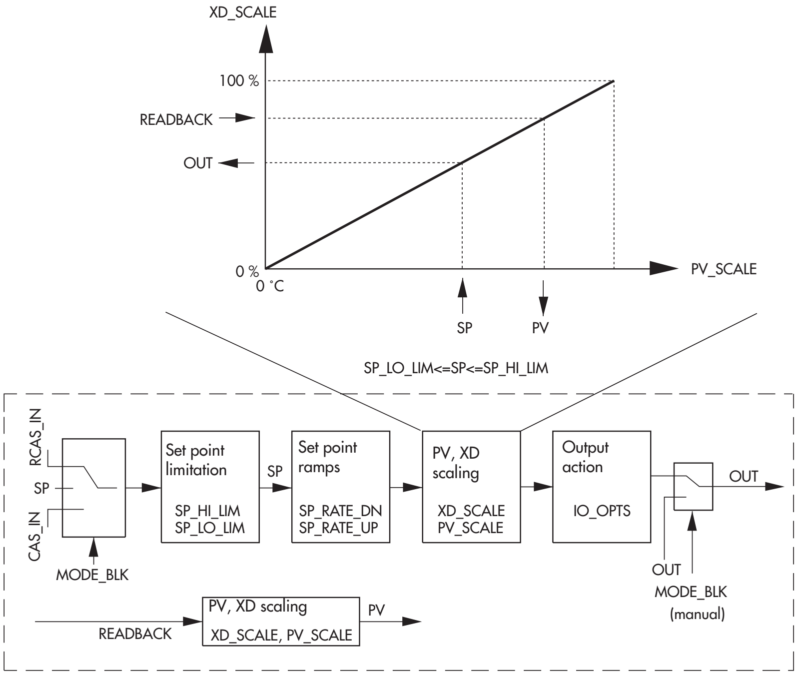


Fig. 25 · Analog Output Function Block

17.2.5 Discrete Input Function Block DI1

The Type 3730-5 Positioner is fitted with a standard contact input to process binary voltage signals.
The Discrete Input DI1 Function Block is used for processing the contact input (terminals 87 und 88) and to integrate a FOUNDATION™ fieldbus application.

The connected hardware is assigned to the function block by CHANNEL = 1. The OUT_D parameter is used to link the state of the contact to other function blocks.
Alternatively, an integrated solenoid valve MGV, a discrete valve position with three states POS_D as well as the Condensed State (NAMUR status) can be processed.

The binary signal to be linked can be selected over the SELECT_BINARY_INPUT_1 parameter in the Resource Block.

Refer to page 150 for the list of parameters.

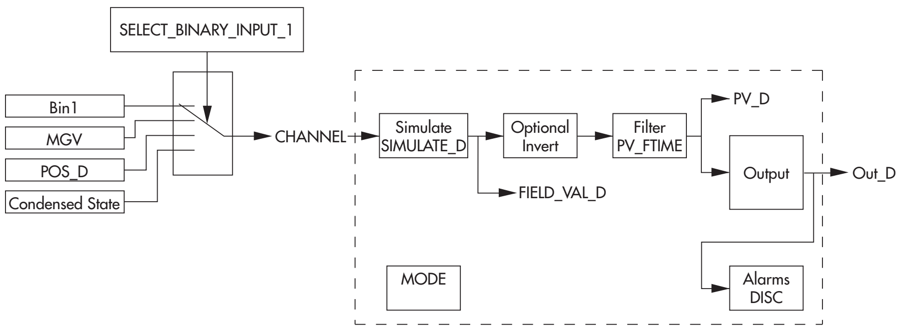


Fig. 26 · Discrete Input Function Block 1

17.2.6 Discrete Input Function Block DI2

The Type 3730-5 Positioner is optionally fitted with a binary input to process a floating contact. The Discrete Input DI2 Function Block is used for processing the contact input (terminals 85 und 86) and to integrate a FOUNDATION™ fieldbus application.
The connected hardware is assigned to the function block by CHANNEL = 2.
The OUT_D parameter is used to link the state of the contact to other function blocks.
Alternatively, an integrated solenoid valve MGV, a discrete valve position with three states POS_D as well as the Condensed State (NAMUR status) can be processed.
The binary signal to be linked can be selected over the SELECT_BINARY_INPUT_2 parameter in the Resource Block.
When a pressure sensor (leakage sensor) is connected, its switching state can be issued as a diagnostic alarm in the XD_ERROR_EXT parameter of the AO Transducer Block and logged.
In this case, the option LEAKAGE SENSOR must be activated in CONFIG_BINARY_INPUT2.
Alternatively, the switching state of the binary input can be issued in the BINARY_INPUT2 parameter of the AO Transducer Block.

Parameters of the Discrete Input Function Block 2

The parameters of the DI Function Block 2 are the same as the parameters of DI Function Block 1.

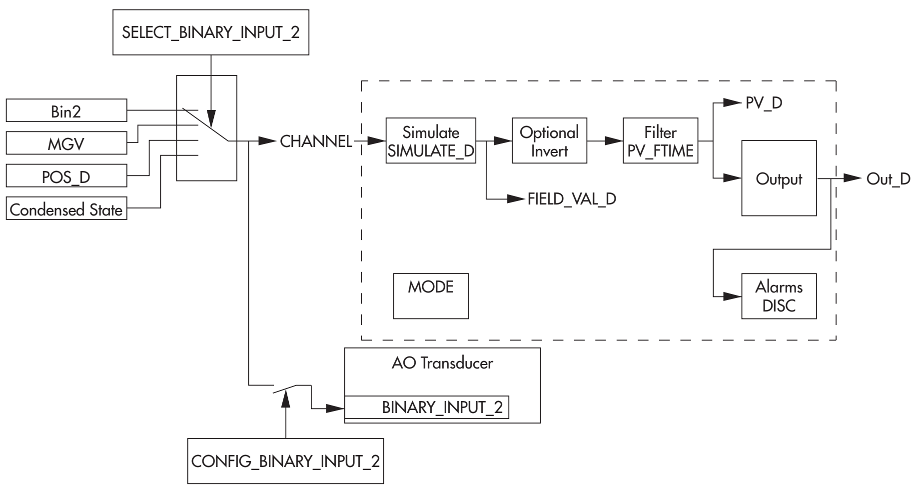


Fig. 27 · Discrete Input Function Block 2

17.2.7 PID Function Block

A PID Function Block contains the input channel processing, the proportional-integral-derivative (PID) control loop and the analog output channel processing.
The configuration of the PID Block (PID controller) depends on the automation task.
Simple control loops, control loops with manipulate variable feedforwarding, cascade control and cascade controls with limitation in combination with another controller function block can be implemented.
The following options are available for processing the measured variable within the PID Function Block (PID controller): Signal scaling and limiting, mode control, feedforward control, limit control, alarm limit detection and signal status propagation.
The PID Block (PID controller) can be used for various automation strategies. The block has a flexible control algorithm that can be configured to match the application.

The PID Block receives its set point depending on the mode (MODE_BLK) from the input variables CAS_IN, RCAS_IN or SP. PV_SCALE, SP_HI_LIM, SP_LO_LIM, SP_RATE_UP and SP_RATE_DN are used to generate an internal operating set point.

The block receives the actual value over the IN input variable which is used to generate the process variable PV, taking into account the PV_SCALE and the filter of the first order PV_FTIME.

These values are fed to the internal PID algorithm. This algorithm consists of a proportional, an integral and a derivative component. The manipulated variable is calculated from the set point value SP and the process variable PV (actual value) resulting from the system deviation.

The individual PID components are included in the calculation of the manipulated variable as follows:

- Proportional component:
  The proportional component reacts immediately and directly when the set point SP or the process variable PV (actual value). The manipulated variable is changed by the proportional factor GAIN. This change corresponds to the system deviation multiplied by the gain factor. If a controller works only with a proportional component, the control loop has a permanent system deviation.
- Integral component:
  The system deviation resulting from the calculation of the manipulated variable using the proportional component is integrated over the integral component of the controller until it is negligible. The integral function corrects the manipulated variable depending on the size and duration of the system deviation. If the value for the integration time RESET is set to zero, the controller works as a P or PD controller. The influence of the integral component on the control loop increases when the value of the integration time is reduced.

- Derivative component:
  In controlled systems with long delay times, e.g. in temperature control loops, it is better to use the derivative component RATE of the controller. Using the derivative component RATE, the manipulated variable is calculated depending on the rate of change of the system deviation.

An output value OUT is formed from the calculated manipulated variable corresponding to the OUT_SCALE, OUT_HI_LIM and OUT_LO_LIM parameters. This output value can be passed on to a downstream connected function block.
The status of the output value OUT can be influenced by the STATUS_OPTS parameter depending on the status of the input variable of the PID Block. This allows, for example, the fault state of a downstream connected output block to be activated.
The BYPASS parameter allows the internal set point to be directly transferred to the correction value. Feedforward is possible over the FF_VAL input variable. TRK_IN_D and TRK_VAL allow the output value to be directly tracked.

Refer to page 154 for the list of parameters.

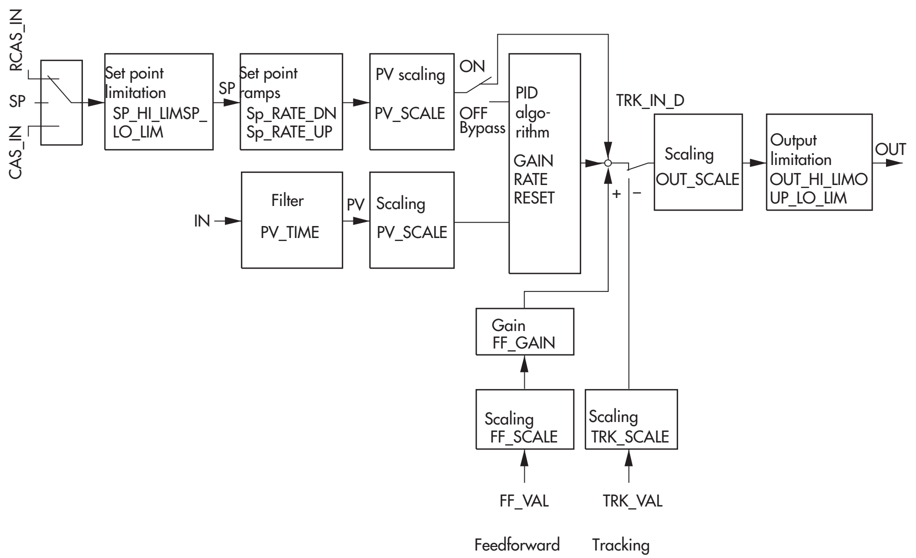


Fig. 28 · PID Function Block

17.3 Other parameters

17.3.1 Stale Counter

The Stale Counter serves to judge the quality of a process variable received over a configured cyclic connection (publisher/subscriber connection).
These connections are used to transfer the process variable linked amongst the various function blocks. For this purpose, the upstream block (publisher) sends the process variable over the bus at scheduled times. The downstream block(s) (subscriber) responds at the scheduled times. The blocks that are to receive data monitor whether a valid value exists at the scheduled time. A value is valid if it exists with the status "Good" at the scheduled time.
The Stale Counter defines how many "Bad" (stale) values can be accepted in sequence before the Fault State of the block is activated.
This monitoring function is deactivated by setting the Stale Counter to zero.

17.3.2 Link Objects

Link Objects are used to link the inputs and outputs of the function blocks (configurable cyclic connections).
A maximum of 22 Link Objects can be configured for each positioner.

17.3.3 LAS Functionality

The number of links and schedules that can be used is matched to the requirements of standard process control systems available on the market.

The positioner functioning as an LAS can support the following:

- 1 schedule
- 1 subschedule
- 25 sequences per subschedule
- 25 elements per sequence

In the delivered state, the positioner is configured as a basic device.

17.4 Parameter lists

Legend

SK (class of memory):	S	Static parameter
	D	Dynamic parameter
	N	Non-volatile parameter
Read/write capability: (access)	r	Read capability
	w	Write capability
Supported modes:	O	O/S (out of service) mode
	M	MAN mode
	A	AUTO mode
	CAS	Cascade mode
	RCAS	Remote cascade mode
	ALL	O/M/A/CAS/RCAS
	NA	Not analyzed
Other modes:	LO	Local override mode
	ROUT	Remote output mode

Resource Block

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
ACK_OPTION	38	S	r/w	O/A	[Undefined] . . . No selection DISC ALM . . . Write lock changed BLOCK ALM . . Block alarm
ALARM_SUM	37	S	r/w	O/A	DISC ALM . . . Write lock changed BLOCK ALM . . Block alarm
ALERT_KEY	4	S	r/w	O/A	1 to 255, [0] "0" is not a permissible value and will be rejected when transferring data to the device (alarm).
BLOCK_ALARM	36	D	r		
BLOCK_ERR	6	D	r		SIMULATE ACTIVE . . . . OUT OF SERVICE . . . . LOST STATIC DATA . . . . DEVICE NEEDS MAINTENANCE SOON . . . . . . DEVICE NEEDS MAINTENANCE NOW . . . .
BUS_ADDRESS	55	D	r		1 to 255, [248]
CLR_FSTATE	30	D	r/w	O/A	
CONDENSED_STATE	59	D	r		0. . OK 1. . Maintenance required 2. . Maintenance demanded 3 . Maintenance alarm 7 . Function check
CONFIRM_TIME	33	S	r/w	O/A	[640000 1/32 ms]
CYCLE_SEL	20	S	r/w	O/A	[SCHEDULED] COMPLETION OF BLOCK EXECUTION
CYCLE_TYPE	19	S	r		SCHEDULED COMPLETION OF BLOCK EXECUTION
DD_RESOURCE	9	S	r		

Description
Determines whether an alarm is to be automatically acknowledged in the positioner, i.e. without intervention of the fieldbus host system. **Note**: The alarm is broadcast to the fieldbus host system, but not acknowledged by it.
Determines the current state of the process alarms in the Resource Block.
Used to specify the identification number of the plant section. This information can be used by the fieldbus host system to group alert and events.
Indicates the current block state with details on all configuration, hardware or system problems in the block.
Indicates active block error **Note**: The assignment of error or diagnostic alarms to the desired function block is determined using the ERROR_OPTION parameter in the Transducer Block. . . Simulation jumper active, simulation possible . . Block mode is out of service . . Data in EEPROM lost . . Maintenance required soon. Block Alarm (BLOCK_ALM) in Resource Block is triggered. . . Maintenance required immediately. Block Alarm (BLOCK_ALM) in Resource Block is triggered.
Bus address
Used to manually clear the Fault State of the AO Function Block.
Indicates the condensed state of the device. Each possible event or error is classified. This assignment can be modified in the Transducer Block. The condensed state provides a summary of all classified status alarms. The state is also indicated on the LCD of the positioner. “Maintenance required” and “Maintenance demanded” are indicated by a wrench symbol, “Maintenance alarm” by the fault symbol. “Function check” is indicated as a text alert.
Specifies the time the device waits for confirmation that an alert report was received before trying again.
Specifies the block execution method determined by the fieldbus host system. **Note**: The block execution method is selected directly in the fieldbus host system.
Indicates the block execution method supported by the device.
Specifies the resource that contains the Device Description file in the device. **Note**: If the device contains no Device Description, “zero” appears on the display.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
DD_REV	**13**	S	r		
DESCRIPTOR	**46**	S	r/w	A/O	
DEV_REV	**12**	S	r		
DEV_TYPE	**11**	S	r		2 for Type 3730-5
DEVICE_CERTIFICATION	**45**	N	r		
DEVICE_PRODUCT_ NUM	**48**	N	r		
DEVICE_SER_NUM	**44**	N	r		
DEVICE_MESSAGE	**47**	N	r/w	A/O	
FAULT_STATE	**28**	N	r		
FEATURES	**17**	S	r		
FEATURES_SEL	**18**	S	r/w	A/O	REPORTS . . . . HARD W LOCK . . . . FAULTSTATE. . . . . OUT READBACK. . . . .
FREE_SPACE	**24**	D	r		
FREE_TIME	**25**	D	r		
GRANT_DENY	**14**	D	r/w	NA	
HARD_TYPES	**15**	S	r		SCALAR OUTPUT (scalable analog output variable)
HW_REVISION	**43**	S	r		
ITK_VER	**41**	S			
LIM_NOTIFY	**32**	S	r/w	A/O	0 to [8]

Description
Specifies the revision number of the Device Description file.
Any desired text to describe the application; the text is saved in the field device.
Indicates the manufacturer's revision number associated with the device.
Indicates the manufacturer's model number associated with the device in decimal format.
Specifies the type of protection of the device, i.e. whether explosion protection certificates are available for the field device.
Specifies the positioner's product number
Specifies the positioner's serial number; allows the field device to be clearly identified in conjunction with the MANUFAC_ID and DEV_TYPE parameters.
Any desired text; the text is saved in the field device.
Indicates the current status of the Fault State of the Analog Output Function Block
Specifies the additionally supported Resource Block options, see FEATURES_SEL.
Enables selection of additionally supported Resource Block options. . . Fieldbus host system needs to acknowledge receipt of an alert report. . . Hardware write lock switch is evaluated . . Fault State can be triggered (see SET_FSTATE /CLR_FSTATE). . . Current valve position issued in the PV parameter of the Analog Function Block (otherwise SP). **Note**: If the AO Block should not move to the MAN mode when the solenoid valve fails, deactivate this option.
Indicates the memory in percent available for implementation of additional function blocks. **Note**: This parameter is not supported as no further function blocks may be added to the Type 3730-5.
Indicates the block processing time in percent that is free to process additional blocks. **Note**: This parameter is not supported as no further function blocks may be added to the Type 3730-5.
Grants or denies access of a fieldbus host system to the field device. **Note**: This parameter is not supported by Type 3730-5.
Indicates the types of output signal (hardware) available for the Analog Output Function Block.
Specifies the hardware revision number of the electronic/mechanical components.
Specifies the version of the Interoperability Tester used by the Fieldbus Foundation on certifying the device as interoperable.
Specifies the number of alert reports that the device can send without getting a confirmation.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
LOCAL_OP_ENA	**56**	N	r/w	A/O	
MANUFAC_ID	**10**	S	r		0 x 00E099 = SAMSON AG
MAX_NOTIFY	**31**	S	r		8
MEMORY_SIZE	**22**	S	r		
MIN_CYCLE_T	**21**	S	r		640 1/32 ms
MODE_BLK	**5**	N	r/w	A/O	AUTO . . . . O/S. . . . .
NV_CYCLE_T	**23**	S	r		
READING_DIRECTION	**54**	D	r/w	A/O	
RESTART	**16**	D	r/w	A/O	RUN. . . . . RESOURCE (not supported) DEFAULTS . . . . PROCESSOR . . . .
RS_STATE	**7**	D	r		ONLINE . . . . STANDBY. . . . . ONLINE LINKING . . . .
SELECT_BINARY_ INPUT1 SELECT_BINARY_ INPUT2	**57** **58**	N N	r/w r/w	A/O A/O	DI1/2 contact . . . . DI1/2 internal solenoid valve. . . . . DI1/2 discrete final valve position . . . .

Continued on next page

Description
Locks/enables local operation.
Indicates the manufacturer's identification number.
Specifies the maximum number of alert reports that the device can send without getting a confirmation.
Indicates the memory in kilobytes available for additional function blocks. **Note**: This parameter is not supported as no further function blocks may be added to the Type 3730-5.
Indicates the shortest cycle interval that the device can perform (execution time of AO function block 20 ms).
Indicates the actual operating mode of the Resource Block, the permitted modes supported by the Resource Block, and the normal mode. . . The Function Blocks (AO and PID Function Block) are enabled in this mode. . . In this mode, the processing of the Function Blocks (AO and PID Function Block) is stopped. The blocks are set to O/S mode.
Specifies the minimum time interval in which device data are stored to the non-volatile memory. **Note**: The Type 3730-5 saves non-volatile data immediately after transmission.
Rotates the display contents by 180°.
Enables the positioner to be reset in various ways. . . Normal operating state . . Device data and function block linkings are reset to the default settings listed in the specification. . . Warm start of device, processor restarted.
Indicates the current operating state of the Resource Block. . . Standard operating state; the function block is in AUTO mode. . . The Resource Block is in O/S mode. . . The configured links between the function blocks have not been established yet.
Used to select the data to be processed in Discrete Input Block 1/2. . . Switching state of binary input 1/2 . . Switching state of internal solenoid valve . . Current valve position as discrete information: 1 Current valve position < x % 2 Current valve position > x %; 3 Intermediate position The limits for < x % or > x % are set using FINAL_POSITION_VALUE_LIMITS parameter [0.5, 99.5]

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
Continued SELECT_BINARY_ INPUT1 SELECT_BINARY_ INPUT2					DI1/2 condensed state . . . .
SET_FSTATE	**29**	D	r/w	A/O	
SHED_RCAS	**26**	S	r/w	A/O	
SHED_ROUT	**27**	S	r/w	A/O	[640000 1/32 ms]
ST_REV	**1**	N	r		
STRATEGY	**3**	S	r/w	A/O	[0]
SW_REVISION	**42**	N	r		
TAG_DESC	**2**	S	r/w	A/O	[No text], max. 32 characters
TEST_RW	**8**	D	r/w	A/O	
TEXT_INPUT_1 TEXT_INPUT_2 TEXT_INPUT_3 TEXT_INPUT_4 TEXT_INPUT_5	**49** **50** **51** **52** **53**	N N N N N	r/w r/w r/w r/w r/w	A/O A/O A/O A/O A/O	
UPDATE_EVT	**35**	D	r		
WRITE_ALM	**40**	D	r/w	A/O	
WRITE_LOCK	**34**	S	r/w	A/O	LOCKED NOT LOCKED

Description
. . 0 OK 1 Maintenance required 2 Maintenance demanded 3 Maintenance alarm 7 Function check
Enables manual activation of the Fault State of the Analog Output Function Block.
Determines how long function blocks are supposed to check that the connection between the fieldbus host system and the PID Block exists in RCAS mode. When the time has elapsed, the PID Block switches from RCAS mode to the operating mode selected in the SHED_OPT parameter.
Determines how long function blocks are supposed to check that the connection between the fieldbus host system and the PID Block exists in ROUT mode. When the time has elapsed, the PID Block switches from ROUT mode to the operating mode selected in the SHED_OPT parameter.
Indicates the revision number of static data. **Note:** The revision state is incremented by one each time a static parameter in the block is written.
Permits strategic grouping and thus faster processing of blocks. Blocks are grouped by entering the same number in the STRATEGY parameter of each block. **Note:** These data are neither checked nor processed by the Resource Block.
Indicates the firmware version (communication/control).
Assigns a unique description to each block for clear identification.
Note: This parameter is required for conformity tests only and is not used in normal operation.
Any desired text
Indicates that static data were changed, including date and time stamp.
Indicates the state of the write-lock alarm. **Note:** The alarm is triggered when the WRITE_LOCK parameter is unlocked.
Indicates the state of the write-lock alarm. The write-lock can be activated by setting Code 47 to ON. If setting data are to be changed by remote transmission, set Code 47 to OFF.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
WRITE_PRI	39	S	r/w	A/O	[0] . . . . 1 . . . . 2 . . . . 3 to 7 . . . . 8 to 15 . . . .

Parameter index

Index	Parameter
0	–
1	ST_REV
2	TAG_DESC
3	STRATEGY
4	ALERT_KEY
5	MODE_BLK
6	BLOCK_ERR
7	RS_STATE
8	TEST_RW
9	DD_RESOURCE

Index	Parameter
10	MANUFAC_ID
11	DEV_TYPE
12	DEV_REV
13	DD_REV
14	GRANT_DENY
15	HARD_TYPES
16	RESTART
17	FEATURES
18	FEATURES_SEL
19	CYCLE_TYPE

Index	Parameter
20	CYCLE_SEL
21	MIN_CYCLE_T
22	MEMORY_SIZE
23	NV_CYCLE_T
24	FREE_SPACE
25	FREE_TIME
26	SHED_RCAS
27	SHED_ROUT
28	FAULT_STATE
29	SET_FSTATE

Description

Used to set the priority for the WRITE_ALM parameter.
. . The write-lock alarm is not processed.
. . The write-lock alarm is not broadcast to fieldbus host system.
. . Reserved for block alarms
. . The write-lock alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high).
. . The write-lock alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high).

Index	Parameter
30	CLR_FSTATE
31	MAX_NOTIFY
32	LIM_NOTIFY
33	CONFIRM_TIME
34	WRITE_LOCK
35	UPDATE_EVT
36	BLOCK_ALARM
37	ALARM_SUM
38	ACK_OPTION
39	WRITE_PRI

Index	Parameter
40	WRITE_ALM
41	ITK_VER
42	SW_REVISION
43	HW_REVISION
44	DEVICE_SER_NUM
45	DEVICE_CERTIFICATION
46	DESCRIPTOR
47	DEVICE_MESSAGE
48	DEVICE_PRODUCT_NUM
49	TEXT_INPUT_1

Index	Parameter
50	TEXT_INPUT_2
51	TEXT_INPUT_3
52	TEXT_INPUT_4
53	TEXT_INPUT_5
54	READING_DIRECTION
55	BUS_ADDRESS
56	LOCAL_OP_ENA
57	SELECT_BINARY_INPUT1
58	SELECT_BINARY_INPUT2
59	CONDENSED_STATE

Analog Output Transducer Block

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
ACT_FAIL_ACTION	**21**	D	r		UNINITIALIZED . . . . Undefined CLOSING. . . . . (in 0 % position) OPENING . . . . (in 100 % position) INDETERMINATE . . None
ACT_MAN_ID	**22**	D	r/w	O/M/A	
ACT_MODEL_NUM	**23**	S	r/w	O/M/A	
ACT_SN	**24**	S	r/w	O/M/A	
ACT_STROKE_TIME_ DEC	**67**	D	r		
ACT_STROKE_TIME_ INC	**68**	D	r		
ADVANCED_PV_BASIC	**0**	D	r		BLOCK_TAG . . . . . Name of block DD_MEMBER . . . . . 0 (0x0) DD_ITEM . . . . Start index of AO . . . . Transducer Block DD_REVIS. . . . . Revision index of DD PROFILE 33037 (0x810d)
ALERT_KEY	**4**	S	r/w	O/M/A	1 to 255, [0] "0" is not a permissible value and will be rejected when transferring data to the device (error alarm).
AUTOSTART	**111**	D	r/w	O/M/A	
BINARY_INPUT 2	**53**	D	r		
BLOCK_ALARM	**8**	D	r		

Description

Sets the fail-safe action to be performed by the actuator in case of a supply air failure, determined automatically during initialization.

Specifies the actuator manufacturer's identification number.

Clearly identifies the manufacturer of the actuator used with the positioner.

Specifies the type/model number of the actuator used with the positioner.

Specifies the serial number of the actuator used with the positioner.

Specifies the minimum transit time to reach CLOSED position

The minimum transit time to reach CLOSED (0 % position) position is the actual time in seconds that the system (consisting of positioner, actuator and valve) needs to move through the rated travel range/angle of rotation to close the valve (measured during initialization).

Specifies the minimum transit time to reach OPEN position

The minimum transit time to reach OPEN (100 % position) position is the actual time in seconds that the system (consisting of positioner, actuator and valve) needs to move through the rated travel range/angle of rotation to open the valve (measured during initialization).

Indicates block-specific and device-specific data.

PROFILE_REVISION. . . . 1 (0x1)
EXECUTION_TIME . . . . Execution time of block
EXECUTION_PERIOD . . Repetition interval
NUM_OF_PARAMS . . . No. of block parameters
NEXT_FB_TO_EXECUTE. Next function block to be executed
VIEWS_INDEX . . . . Initial address of View objects
NUMBER_VIEW_3 . . . . Number of View-3 objects
NUMBER_VIEW_4 . . . . Number of View-4 objects

Used to specify the identification number of the plant section.

This information can be used by the fieldbus host system to group alert and events.

Indicates the interval at which the step response function is repeated.

Note: Available in versions with ESD diagnostics and higher.

Indicates the state of DI2.

The value of the output depends on CONFIG_BINARY_INPUT2.

Indicates the current block state with details on all configuration, hardware or system problems in the block.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
BLOCK_ERR	6	D	r		OUT OF SERVICE . . . . DEVICE NEEDS MAINTENANCE NOW . . . . DEVICE NEEDS MAINTENANCE SOON . . . . . . LOCAL OVERRIDE. . . . . INPUT FAILURE . . . . OUTPUT FAILURE . . . . MEMORY FAILURE . . . . LOST STATIC DATA . . . .
BLOCKING_POSITION	76	D	r/w	O/M/A	
CLOSING_DIRECTION	66	S	r/w	O/M/A	
COLLECTION_ DIRECTORY	12	D	r		
CONFIG_BINARY_ INPUT2	56	D	r/w	O/M/A	[NOT EVALUATED] ACTIVELY OPEN ACTIVELY CLOSED ACTIVELY OPEN – LEAKAGE SENSOR ACTIVELY CLOSED – LEAKAGE SENSOR
COUNTER_INIT_START	85	D	r		
DATALOGGER_ PROGRESS	95	D	r		1. . Trigger select 2. . Trigger not select 3. . Trigger start by travel condition 4. . Trigger start by solenoid condition 5. . End measuring, memory full
DATALOGGER_SELECT	88	D	r/w	O/M/A	1. . Permanent 2. . Trigger
DEAD_TIME_FALLING	115	D	r		
DEAD_TIME_RISING	114	D	r		

Description
Reflects the active errors associated with a block. . . Block mode is out of service. . . Maintenance required immediately (error in the electronics). . . Maintenance required soon (zero error, positioner fault, or total valve travel exceeded). . . Output value set to "local operation" using TROVIS-VIEW, or forced venting function/zero calibration or initialization currently in process. . . Position feedback error or device not initialized . . Device not initialized . . Memory error . . Check sum error
Indicates and modifies the blocking position (see Code 35).
Indicates and modifies the closing direction (see Code 34).
This parameter is not processed by Type 3730-5.
Sets the logic state of DI2. The parameter is processed by the BINARY_INPUT2 parameter. The parameter settings do not depend on Transducer Block DI2.
Specifies the number of initialization cycles that have been performed since the last reset.
Indicates the state of the data logger. Available in versions with EXPERT+ extended diagnostics and higher.
Permits selection of data logger recording method. Available in versions with EXPERT+ extended diagnostics and higher
Specifies the time that has elapsed until a change in the valve position x occurs after a falling step change of the reference variable w (during diagnostic test). Available in versions with EXPERT+ extended diagnostics and higher.
Specifies the time that has elapsed until a change in the valve position x occurs after a rising step change of the reference variable w (during diagnostic test). Available in versions with EXPERT+ extended diagnostics and higher.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
DELAY_TIME	**46**	S	r/w	O/M/A	1 to 240 s, [10 s]
DEVIATION_MAX	**98**	D	r		
DEVIATION_MIN	**97**	D	r		
DEVICE_ CHARACTERISTICS	**32**	S	r/w	O/M/A	ACTUATOR_SIZE ACTUATOR_VERSION ATTACHMENT PRESSURE_RANGE_START PRESSURE_RANGE_END SUPPLY_PRESSURE
DEVICE_INIT_STATE	**64**	D	r		
DIAG_LEVEL	**101**	D	r		EXPERT . . . Standard valve diagnostics EXPERT+Extended valve diagnostics ESD . . . . . . Emergency shutdown
ELAPSED_HOURS_ METERS	**82**	D	r		ELAPSED_HOURS_TOTAL . . . . ELAPSED_HOURS_IN_CLOSED_LOOP . . . . ELAPSED_HOURS_SWITCHED_ON_SINCE_ INIT ELAPSED_HOURS_IN_CLOSED_LOOP_SINCE_INIT
ENHANCED_DIAG_ CMD	**81**	D	r/w	O/M/A	1. . No function 2. . Start data logger 3. . Abort data logger
ERROR_OPTION_ DATA_FAILURE	**39**	S	r/w	O/M/A	1. . Control parameter 2. . Potentiometer parameter 3. . Adjusted parameter

Description	
Specifies the delay time (reset criterion when control loop monitoring is in progress). If the entered DELAY_TIME is exceeded and the system deviation is outside the specified TOLERANCE_BAND, a control loop error is issued. Determined from the minimum transit time during initialization.	
Specifies the positioner's maximum system deviation that has occurred. Available in versions with EXPERT$^+$ extended diagnostics and higher.	
Specifies the positioner's minimum system deviation. Available in versions with EXPERT$^+$ extended diagnostics and higher.	
Reflects positioner-specific data. BOOSTER STUFFING_BOX SEALING_EDGE (plug/seat facing) PRESSURE_BALANCING FLOW_CHARACTERISTIC FLOW_DIRECTION	 NOM_DIAMETER NOM_DIAMETER_DN KVS_UNIT KVS_VALUE SEAT_DIAM_VALVE
Indicates whether the device has been initialized.	
Indicates the currently installed diagnostic version.	
Indicates the hours the device has been in operation. . . Total hours the device has been switched on . . Device in closed loop . . Hours the device has been switched on since last initialization . . Hours in closed loop control since last initialization	
Indicates an extended diagnostic test. 4. . Hysteresis online test 5. . Abort hysteresis online test 6. . Start step response	 7. . Abort step response 8. . Start tests in turn
Indicates the masking of data errors. 4. . General parameter 5. . Internal device error 1 6. . Valve dimension parameter	 7. . Info parameter 8. . Check sum program code

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
ERROR_OPTION_ENH_ DIAGNOSTIC_1 to ERROR_OPTION_ENH_ DIAGNOSTIC_5	40 to 44	S S	r/w r/w	O/M/A O/M/A	
ERROR_OPTION_HW_ FAILURE	38	S	r/w	O/M/A	1. . x signal 2. . i/p converter
ERROR_OPTION_INIT_ FAILURE	36	S	r/w	O/M/A	1. . x > range 2. . Delta x < range 3. . Mechanics/pneumatics
ERROR_OPTION_ OPERATION_FAILURE	37	S	r/w	O/M/A	1. . Control loop 2. . Zero point
ERRORBYTE	106	D	r		
EVENT_LOGGING_1 EVENT_LOGGING_2	86 87	D D	r r		
FINAL_POSITION_ VALUE	20	D	r		
FINAL_POSITION_ VALUE_DISC	52	D	r/w		
FINAL_POSITION_ VALUE_LIMITS	51	D	r/w	O/M/A	FINAL_POSITION_VALUE_LIMITS FINAL_POSITION_VALUE_HIGH_LIMIT FINAL_POSITION_VALUE_LOW_LIMIT
FINAL_VALUE	13	N	r/w	O/M	Scaling over FINAL_VALUE_RANGE
FINAL_VALUE_ CUTOFF_HI	15	S	r/w	O/M/A	0 to 125 %, [99 %]

Description	
Specifies the masking of diagnostic status or error alarms.	
Specifies the masking of hardware errors.	
3. . Hardware	5. . Control calculation
4. . Data memory	6. . Program loading error
Specifies the masking of initialization errors.	
4. . Init. time exceeded	7. . Pin position
5. . Init./solenoid valve	8. . No emergency mode
6. . Travel time too short	
Specifies the masking of operating errors.	
3. . Autocorrection	5. . w too small
4. . Fatal error	6. . Total valve travel exceeded
Specifies the cancellation flag of the step response (criterion for cancelation). Available in versions with EXPERT+ extended diagnostics and higher.	
Indicates the logs 0 – 14 with the time they were recorded. Indicates the logs 15 – 29 with the time they were recorded.	
Specifies the current valve position in % in relation to the operating range FINAL_VALUE_RANGE.	
Specifies FINAL_POSITION_VALUE_LIMITS, e.g. limit values reached or status of the value.	
Indicates the limit of FINAL_POSITION_VALUE. This actual value is sent to the AO Transducer Block directly from the valve.	
Contains the output value received from the upstream AO Function Block.	
Final position if set point exceeds the adjusted value (see Code 15). If the set point exceeds the adjusted value, the valve is moved to the final position that corresponds to 100 % of the manipulated variable. This causes the actuator to either be vented completely or fully filled with air (corresponding to the fail-safe action). **Note:** The function is deactivated by entering –2.5 %. As this function causes the actuator to be fully vented or filled with air, the valve moves to its absolute final position. Restrictions set by the travel range or travel limitation functions do not apply. In the case that this creates excessive positioning forces, this function must be deactivated.	

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
FINAL_VALUE_ CUTOFF_HI_ON	**75**	S	r/w	O/M/A	
FINAL_VALUE_ CUTOFF_LO	**16**	S	r/w	O/M/A	–2.5 to 100 %, [1 %]
FINAL_VALUE_ CUTOFF_LO_ON	**74**	S	r/w	O/M/A	
FINAL_VALUE_RANGE	**14**	S	r/w	O	FINAL VALUE RANGE EU_100 (see Code 9) FINAL VALUE RANGE EU_0 (see Code 8) FINAL VALUE RANGE UNITS_INDEX FINAL VALUE RANGE DECIMAL
HIS_TEMPERATURE	**100**	D	r		T_CURRENT_TEMPERATURE . . . . T_MAX_TEMPERATURE . . . . HIS_T_ZEIT_MAX_TEMPERATUR . . . . T_MIN_TEMPERATURE . . . . HIS_T_ZEIT_MIN_TEMPERATUR . . . . TEMP_PERIOD_TIME_HIGH . . . . TEMP_PERIOD_TIME_LOW . . . .
HISTOGRAMM_X	**96**	D	r		
HISTOGRAMM_Z	**99**	D	r		
HYS_STELL_Y	**102**	D	r/w	O/M/A	

Description
Enables the final position w > (see Code 15).
Final position if set point falls below adjusted value (see Code 14). If the set point falls below the adjusted value, the valve is moved to the final position that corresponds to 0 % of the manipulated variable. This causes the actuator to either be vented completely or fully filled with air (corresponding to the fail-safe action). **Note**: The function is deactivated by entering –2.5 %. As this function causes the actuator to be fully vented or filled with air, the valve moves to its absolute final positions. Restrictions set by the travel range or travel limitation functions do not apply. In the case that this creates excessive positioning forces, this function must be deactivated.
Enables final position w< (see Code 14).
Sets the travel range/angle of rotation. The set point FINAL_VALUE is sent to the AO Transducer Block directly from an upstream AO Function Block. **Note:** The operating range FINAL_VALUE_RANGE is compared with the TRANSM_PIN_POS. If the TRANSM_PIN_POS is changed, the positioner checks whether the setting and unit matches the current operating range FINAL_VALUE_ RANGE. If this is not the case, the operating range FINAL_VALUE_RANGE is set to 0-100 %.
Indicates temperature-specific data. . . Current temperature . . Max. temperature . . Duration of max. temperature . . Min. temperature . . Duration of min. temperature . . Time the temperature below 80 °C . . Time the temperature below –40 °C
Reflects the valve position x. The valve position histogram provides a static evaluation of the recorded travel positions. The histogram indicates, for example the travel range in which the valve has mainly been operating and whether a recent trend can be recognized, indicating a change of the main operating range. Available in versions with EXPERT$^+$ extended diagnostics and higher.
The cycle counter records the number of spans and the associated heights of the spans, which are categorized in fixed intervals (classes). The cycle counter histogram provides a static evaluation of the cycle spans, thus furnishing data on the dynamic stress that a bellows or an installed packing are exposed to. Available in versions with EXPERT$^+$ extended diagnostics and higher.
Specifies the minimum interval at which hysteresis tests are performed. Available in versions with EXPERT$^+$ extended diagnostics and higher.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
IDENT_LIMIT_SWITCHES	**55**	D	r/w	O/M/A	NOT IMPLEMENTED IMPLEMENTED [depending on hardware upgrade]
IDENT_OPTIONS	**54**	D	r		1. . Not implemented 2. . Binary input 2 3. . Solenoid valve 4. . Limit switch
INIT_METHOD	**60**	S	r/w	O/M/A	0. . Maximum range 1. . Nominal range 2. . Manual adjustment 3. . Substitute 4. . Zero point
KP_STEP	**17**	S	r		
LATENCY_AFTER_STEP	**109**	S	r/w	O/M/A	0 to 120 s, [1 s]
LIN_TYPE	**69**	S	r/w	O/M/A	1. . Linear 2. . Equal percentage 3. . Equal percentage reverse 4. . SAMSON butterfly linear
LOGGING_LIMIT	**92**	D	r/w	O/M/A	1. . Lower limit 2. . Upper limit
MODE_BLK	**5**	S	r/w	O/M/A	AUTO Automatic . . . . O/S Out of Service . . . . MAN . . . . LO Local Override . . . .
MOVING_DIRECTION	**65**	S	r/w	O/M/A	

Description
Specifies whether optional inductive limit switches are installed. Limit switches are not detected automatically; they need to be entered manually (see Code 38).
Indicates which optional components are installed.
Indicates the selected initialization mode (see Code 6).
Specifies K_P (see Code 17). This parameter can only be read over FOUNDATION fieldbus. The value is detected during initialization.
This parameter sets the waiting time required to jump back from the final value of the first step change to the initial value of the second step change (reverse step change). Available in versions with EXPERT+ extended diagnostics and higher.
Sets the characteristic (see Code 20) 5. . SAMSON butterfly equal percentage 6. . VETEC rotary linear 7. . VETEC rotary equal percentage 8. . Segmented ball valve linear 9. Segmented ball valve equal percentage 10. User defined
Indicates the initial value of an event that triggers logging. Available in versions with EXPERT+ extended diagnostics and higher.
Used to indicate/select the actual mode of the Resource Block, the permitted modes supported by the Transducer Block, and the normal mode. . . In this operating mode, a positioning value is calculated from the output value from the AO Function Block and the control valve is positioned accordingly. . . In this operating mode, the output value from the AO Function Block is not used. The control valve is moved to its mechanical fail-safe position set by ACT_FAIL_ACTION. The mode is also changed to O/S when the forced venting function is triggered. . . In this operating mode, FINAL_VALUE can be entered manually (display:). . . If the device is locally set to the MAN mode, the Analog Output Transducer Block is set to LO.
Specifies the direction of action of the reference variable w in relation to the controlled variable x (see Code 7).

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
NO_OF_ZERO_ POINT_ADJ	**83**	D	r		
OVERSHOOT_FALLING	**113**	D	r		
OVERSHOOT_RISING	**112**	D	r		
PRESSURE_LIMIT	**80**	S	r/w	O/M/A	1. . Off . . . . 3. . 2.4 bar 2. . 3.7 bar . . . . . . 4. . 1.4 bar
PRESSURE_Y	**50**	D	r		
PRETRIGGER_TIME	**93**	D	r/w	O/M/A	
RAMP_DOWN	**108**	D	r/w	O/M/A	[0]
RAMP_UP	**107**	D	r/w	O/M/A	[0]
RATED_TRAVEL	**58**	S	r/w	O/M/A	0 to 255.9 mm, [15.0 mm]
SAMPLE_RATE	**90**	D	r/w	O/M/A	

Description
Specifies the number of zero calibrations performed since the last initialization.
Evaluation parameter for step response test. Overshooting of falling reference variable step change. Available in versions with EXPERT+ extended diagnostics and higher.
Evaluation parameter for step response test. Overshooting of rising reference variable step change. Available in versions with EXPERT+ extended diagnostics and higher.
Used to set the pressure limit (see Code 16).
Specifies the actuator pressure in percent after initialization (see Code 44).
The data logger can be triggered as soon as a certain event occurs. The pretrigger function can be used to display data recorded before this event. This is made possible by a ring buffer in which all events are saved continuously. For example, if the pretrigger time is set to 1 s, all events that occurred in the second before the data logger was triggered are displayed. Available in versions with EXPERT+ extended diagnostics and higher.
The dynamic control response of the control valve can be tested by recording step responses. Sets the time in which the reverse step change is expected to fall. Available in versions with EXPERT+ extended diagnostics and higher.
The dynamic control response of the control valve can be examined by recording step responses. Sets the time in which the reverse step change is expected to rise. Available in versions with EXPERT+ extended diagnostics and higher.
Specifies the rated travel [mm] or rotational angle [degrees] of the valve (see Code 5). **Note**: The unit [mm] or [degrees] depends on the VALVE_TYPE parameter.
Used to set the sampling rate of the data logger in ms. Available in versions with EXPERT+ extended diagnostics and higher.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
SELF_CALIB_CMD	**61**	D	r/w	O/M/A	1 . . No test, normal operation 2 . . Start with default values 3 . . Start initialization 4 . . Abort initialization 5 . . Start zero point adjustment 6 . . Abort zero point adjustment 7 . . Search device 8 . . Reset "Total valve travel" /*xd_error_ext_1*/ 9 . . Reset "Solenoid valve active" 10 . . Reset "Total valve travel limit exceeded" 11 . . Reset "Control loop" 12 . . Reset "Zero point"
SELF_CALIB_STATUS	**63**	D	r		1 . . Not active 2 . . Running 3 . . Test aborted 4 . . Zero point adjustment
SERVO_RESET	**18**	S	r		
SET_FAIL_SAFE_POS	**57**	S	r/w	O/M/A	1 . . Not active 2 . . Set fail-safe position 3 . . Clear fail-safe position
SETP_DEVITATION	**45**	D	r		
SIGNAL_PRESSURE_ ACTION	**77**	D	r		
SOLENOID_SELECT	**94**	D	r/w	O/M/A	
ST_REV	**1**	S	r		
START_VALUE	**91**	D	r/w	O/M/A	

Description

Starts the calibration sequences in the field device and the resetting of error alarms.

13 . . Reset "Autocorrection"
14 . . Reset "Fatal error"
15 . . Reset "Extended diagnosis"
16 . . Reset "x > range"
17 . . Reset "Delta x < range"
18 . . Reset "Attachment"
19 . . Reset "Initialization time exceeded"
20 . . Reset "Initialization/solenoid valve"
21 . . Reset "Travel time too short"
22 . . Reset "Pin position" /*xd_error_ext_2*/
23 . . Reset "x signal"
24 . . Reset "i/p converter"
25 . . Reset "Hardware"
26 . . Reset "Control parameter"
27 . . Reset "Poti parameter"
28 . . Reset "Adjustment parameter"
29 . . Reset "General parameter"
30 . . Reset "Internal device error 1"
31 . . Reset "No emergency mode"
32 . . Reset "Program load error"
33 . . Reset "Options parameter"
34 . . Reset "Info parameter"
35 . . Reset "Data memory"
36 . . Reset "Control calculation"
37 . . Reference_Test_Aborted

Indicates the state of the calibration sequence started with SELF_CALIB_CMD.

5 . . Maximum point adjustment
6 . . Detection of mech. steps
7 . . Controller optimization
8 . . Fine adjustment
9 . . Step 1 (step response)
10 . . Step 2 (step response)
11 . . Terminated

This parameter is not processed by Type 3730-5.

Allows the valve to be moved to its actual fail-safe position. Fail-safe position is indicated by an S blinking on the display.

Indicates the system deviation e (see Code 39).

This parameter is determined during initialization and indicates the position of the slide switch (AIR TO OPEN/CLOSE). The positioner needs to be re-initialized when the switch position is changed.

Indicates the status of the solenoid valve (see Code 45).

Note: By selecting "1" (Close) the "Maintenance now" Block of the AO Transducer Block is entered in the AO Block as an "Output Error" block error.

Available in versions with EXPERT+ extended diagnostics and higher.

The revision state of static data is displayed.

Note: The revision state is incremented by one each time a static parameter in the block is written.

The start value is specified for a triggered start condition of the data logger (valve position in %).

Available in versions with EXPERT+ extended diagnostics and higher.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
STEP_PROGRESS	120	D	r		
STEP_SAMPLE_RATE	105	D	r/w	O/M/A	[0.1] to 120 s
STEP_SELECTION	110	D	r/w	O/M/A	1. . One step 2. . Two steps
STEPEND	104	D	r/w	O/M/A	0 to [100 %]
STEPSTART	103	D	r/w	O/M/A	[0] to 100 %
STRATEGY	3	S	r/w	O/M/A	[0]
SUB_MODE_INIT	62	D	r		
TAG_DESC	2	S	r/w	O/M/A	Max. 32 characters
TIME_63_FALLING	117	D	r		
TIME_63_RISING	116	D	r		
TIME_98_FALLING	119	D	r		
TIME_98_RISING	118	D	r		
TOLERANCE_BAND	47	S	r/w	O/M/A	0.1 to 10 %, [5 %]
TOT_VALVE_TRAV_LIM	49	S	r/w	O/M/A	1000 to 990 000 000, [1 000 000]
TOTAL_VALVE_TRAVEL	48	D	r		

Description
The progress of the step response test is indicated. Available in versions with EXPERT+ extended diagnostics and higher.
Used to set the sampling rate of the step response logging Available in versions with EXPERT+ extended diagnostics and higher.
The dynamic control behavior of the valve can be tested by recording the step responses. Two reference variable steps are performed by default and the course of the valve position x and the manipulated variable y are plotted until they reach a steady state. The first step starts at an intial value defined beforehand and finishes at the determined final value. After the entered waiting time, the second step is performed in reverse starting with the final value back to the initial value. This parameter is used to select whether just one step is to be performed or whether also the reverse step is to be performed after the first step. Available in versions with EXPERT+ extended diagnostics and higher.
Used to set the final value to perform the step response. Available in versions with EXPERT+ extended diagnostics and higher.
Used to set the initial value to perform the step response. Available in versions with EXPERT+ extended diagnostics and higher.
Permits strategic grouping and thus faster processing of blocks. Blocks are grouped by entering the same number in the STRATEGY parameter of each block. **Note**: These data are neither checked nor processed by the Transducer Block.
Indicates whether an initialization has been performed in the SUB mode.
Assigns a unique description to each block for clear identification
Determined from the step response test T_{63} for the falling step. Available in versions with EXPERT+ extended diagnostics and higher.
Determined from the step response test T_{63} for the rising step. Available in versions with EXPERT+ extended diagnostics and higher.
Determined from the step response test T_{98} for the falling step. Available in versions with EXPERT+ extended diagnostics and higher.
Determined from the step response test T_{98} for the rising step. Available in versions with EXPERT+ extended diagnostics and higher.
Tolerance band (see Code 19)
Indicates limit of absolute total valve travel (see Code 24).
Absolute total valve travel: Sum of the nominal travel cycles (double strokes), total number of valve strokes (see Code 23).

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
TRANSDUCER_ DIRECTORY	9	D	r		
TRANSDUCER_STATE	34	D	r		1. . See operating mode 2. . Solenoid valve active 3. . Lower travel limit active
TRANSDUCER_TYPE	10	N	r		
TRANSM_PIN_POS	59	S	r/w	O/M/A	
TRAVEL_LOWER_LIMIT	71	S	r/w	O/M/A	
TRAVEL_LOWER_LIMIT_ ON	70	S	r/w	O/M/A	
TRAVEL_RATE_DEC	79	S	r/w	O/M/A	
TRAVEL_RATE_INC	78	S	r/w	O/M/A	
TRAVEL_UPPER_LIMIT	73	S	r/w	O/M/A	
TRAVEL_UPPER_LIMIT_ ON	72	S	r/w	O/M/A	
TRIGGER_SELECT	89	S	r/w	O/M/A	1. . Valve position 2. . Solenoid condition 3. . Valve position or solenoid condition
TV_STEP	19	S	r		
UPDATE_EVT	7	D	r		
USER_ CHARACTERISTIC	33	S	r/w	O/M/A	
VALVE_MAN_ID	25	S	r/w	O/M/A	
VALVE_MODEL_NUM	26	S	r/w	O/M/A	
VALVE_SN	27	S	r/w	O/M/A	

Description
This parameter is not processed in Type 3730-5.
Indicates the state of the Transducer Block. 4. . Upper travel limit active 5. . End position < active 6. . End position > active 7. . Fail-safe position active 8. . Normal operation
Indicates the type of transducer. Standard Advanced Positioner Valve in this case.
The pin position must be entered for initialization in NOM or SUB modes. The follower pin must be placed in the correct pin position depending on the valve travel/angle of rotation (see Code 4).
Limits the travel/angle of rotation downwards. The characteristic is not adapted compared to the FINAL_VALUE_RANGE (see Code 10).
Enables the lower x-limit (see Code 10).
Indicates the time required by the valve to move through the operating range when the valve closes (see Code 22).
Indicates the time required by the valve to move through the operating range when the valve opens (see Code 21).
Limits the travel/angle of rotation upwards. The characteristic is not adapted compared to FINAL_VALUE_RANGE (see Code 11)
Enables the upper x-limit (see Code 11)
On selecting TRIGGER in DATALOGGER_SELECT parameter, the user can select which events are to trigger the event logger. Available in versions with EXPERT+ extended diagnostics and higher.
Indicates Tv (see Code 19) **Note:** This parameter can only be read over FOUNDATION fieldbus. The value is recorded during initialization.
Indicates that static data were changed, including date and time stamp.
Allows the user-defined characteristic to be entered. The characteristic to be used is selected over the LIN_TYPE parameter (user-defined in this case). The following condition must be fulfilled in this case: x (t–1) < x (t), i.e. the values for x must continually rise.
Clear identification of the manufacturer of the valve that the positioner is mounted on.
Indicates the model version of the valve that the positioner is mounted on.
Indicates the serial number of the valve that the positioner is mounted on.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
VALVE_TYPE	**28**	S	r/w	O/M/A	UNINITIALIZED . . . . [LINEAR] . . . . ROTARY . . . . OTHER . . . . OFF . . . .
XD_CAL_DATE	**30**	S	r/w	O/M/A	
XD_CAL_LOC	**29**	S	r/w	O/M/A	
XD_CAL_WHO	**31**	S	r/w	O/M/A	
XD_ERROR	**11**	D	r		NONE (0) . . . . UNSPECIFIED ERROR . . . . GENERAL ERROR . . . . CALIBRATION ERROR . . . . CONFIGURATION ERROR . . . . ELECTRONICS FAILURE . . . . MECHANICAL FAILURE . . . . DATA INTEGRITY ERROR . . . . ALGORITHM ERROR . . . .
XD_ERROR_EXT	**35**	D	r		1. . xd_error_ext_1 "Device not initialized" "Solenoid valve active" or "SET_FAIL_SAFE_POS active" "Total valve travel limit exceeded" "Control loop" (see Code 57) "Zero point" (see Code 58) "Autocorrection" (see Code 59) "Fatal error" (see Code 60) "Extended diagnosis" "x > range" (see Code 50) "Delta x < range" (see Code 51) "Attachment" (see Code 52) "Initialization time exceeded" (see Code 53) "Initialization/solenoid valve" (see Code 54) "Travel time too short" (see Code 55) "Pin position" (see Code 56) "Test or calibration running"

Description
Type of valve **Note!** The Type 3730-5 differentiates merely between linear and rotary valves . . (Type 3730-5: Treated like a globe valve) . . (Control valves with straight moving plug, e.g. globe valves) . . (Control valves with rotating closure members) . . (Type 3730-5: Treated like a globe valve) . . The last setting is kept.
Indicates the time when the last calibration was performed.
Indicates the location where the last calibration was performed.
Indicates the person who performed the last calibration.
Errors listed in the Transducer Block . . No error . . Unspecified (device not initialized, initialization or zero calibration in progress or total valve travel exceeded) . . General device error . . Zero point, internal control loop, or initialization error, reference test canceled (Code 81, only with EXPERT+) . . Parameter or characteristic faulty . . i/p converter (Code 64), hardware (Code 65), bus connection . . Fault in the mechanics . . Check sum error . . Dynamic values outside of the range
Extended errors listed in the Transducer Block 2. . xd_error_ext_2 “x signal“ (see Code 62) “i/p converter“ (see Code 64) “Hardware“ (see Code 65) “Control parameter“ (see Code 68) “Poti parameter“ (see Code 69) “Adjustment parameter“ (see Code 70) “General parameter“ (see Code 71) “Internal device error 1“ (see Code 73) “No emergency mode“ (see Code 76) “Program load error“ (see Code 77) “Options parameters“ (see Code 78) “Info parameters“ (see Code 75) “Data memory“ (see Code 66) “Control calculation“ (see Code 67) “Reference test aborted“ (see Code 81) 3. . xd_error_txt_3 (EXPERT+ function) 4 . . Air supply (EXPERT+ function) 5 . . Actuator spring (EXPERT+ function) 6 . . Shifting working range (EXPERT+ function) 7 . . Friction (EXPERT+ function) 8 . . Leakage pneumatic (EXPERT+ function) 9 . . Limit working range (EXPERT+ function) 10 . . Dynamic stress factor (EXPERT+ function) 11 . . Inner leakage (EXPERT+ function) 12 . . External leakage (EXPERT+ function) 13 . . Observing end position (EXPERT+ function) 14 . . Connection positioner valve (EXPERT+ function) 15 . . Working range (EXPERT+ function) 16 . . Emergency shutdown (EXPERT+ function) 17 . . Temperature error (EXPERT+ function)

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
ZERO_POINT_LIMIT	84	D	r/w	O/M/A	

Parameter index

Index	Parameter
0	ADVANCED_PV_BASIC
1	ST_REV
2	TAG_DESC
3	STRATEGY
4	ALERT_KEY
5	MODE_BLK
6	BLOCK_ERR
7	UPDATE_EVT
8	BLOCK_ALARM
9	TRANSDUCER_ DIRECTORY
10	TRANSDUCER_TYPE
11	XD_ERROR
12	COLLECTION_DIRECTORY
13	FINAL_VALUE
14	FINAL_VALUE_RANGE
15	FINAL_VALUE_CUTOFF_HI
16	FINAL_VALUE_CUTOFF_LO
17	KP_STEP
18	SERVO_RESET
19	TV_STEP
20	FINAL_POSITION_VALUE
21	ACT_FAIL_ACTION

Index	Parameter
22	ACT_MAN_ID
23	ACT_MODEL_NUM
24	ACT_SN
25	VALUE_MAN_ID
26	VALUE_MODEL_NUM
27	VALVE_SN
28	VALVE_TYPE
29	XD_CAL_LOC
30	XD_CAL_DATE
31	XD_CAL_WHO
32	DEVICE_CHARACTERISTICS
33	USER_CHARACTERISTIC
34	TRANSDUCER_STATE
35	XD_ERROR_EXT
36	ERROR_OPTION_INIT_ FAILURE
37	ERROR_OPTION_ OPERATION_FAILURE
38	ERROR_OPTION_HW_ FAILURE
39	ERROR_OPTION_DATA_ FAILURE
40	ERROR_OPTION_ENH_ DIAGNOSTIC_1

Index	Parameter
41	ERROR_OPTION_ENH_ DIAGNOSTIC_2
42	ERROR_OPTION_ENH_ DIAGNOSTIC_3
43	ERROR_OPTION_ENH_ DIAGNOSTIC_4
44	ERROR_OPTION_ENH_ DIAGNOSTIC_5
45	SETP_DEVIATION
46	DELAY_TIME
47	TOLERANCE_BAND
48	TOTAL_VALVE_TRAVEL
49	TOT_VALVE_TRAV_LIM
50	PRESSURE_Y
51	FINAL_POSITION_VALUE_ LIMITS
52	FINAL_POSITION_VALUE_ DISC
53	BINARY_INPUT2
54	IDENT_OPTIONS
55	IDENT_LIMIT_SWITCHES
56	CONFIG_BINARY_INPUT2
57	SET_FAIL_SAFE_POS
58	RATED_TRAVEL

Description

Indicates the zero point limit [%]

Index	Parameter
59	TRANSM_PIN_POS
60	INIT_METHOD
61	SELF_CALIB_CMD
62	SUB_MODE_INIT
63	SELF_CALIB_STATUS
64	DEVICE_INIT_STATE
65	MOVING_DIRECTION
66	CLOSING_DIRECTION
67	ACT_STROKE_TIME_DEC
68	ACT_STROKE_TIME_INC
69	LIN_TYPE
70	TRAVEL_LOWER_LIMIT_ ON
71	TRAVEL_LOWER_LIMIT
72	TRAVEL_UPPER_LIMIT_ON
73	TRAVEL_UPPER_LIMIT
74	FINAL_VALUE_CUTOFF_ LO_ON
75	FINAL_VALUE_CUTOFF_ HI_ON
76	BLOCKING_POSITION
77	SIGNAL_PRESSURE_ ACTION
78	TRAVEL_RATE_INC

Index	Parameter
79	TRAVEL_RATE_DEC
80	PRESSURE_LIMIT
81	ENHANCED_DIAG_CMD
82	ELAPSED_HOURS_METERS
83	NO_OF_ZERO_POINT_ ADJ
84	ZERO_POINT_LIMIT
85	COUNTER_INIT_START
86	EVENT_LOGGING_1
87	EVENT_LOGGING_2
88	DATALOGGER_SELECT
89	TRIGGER_SELECT
90	SAMPLE_RATE
91	START_VALUE
92	LOGGING_LIMIT
93	PRETRIGGER_TIME
94	SOLENOID_SELECT
95	DATALOGGER_PROGRESS
96	HISTOGRAMM_X
97	DEVIATION_MIN
98	DEVIATION_MAX
99	HISTOGRAMM_Z
100	HIS_TEMPERATURE

Index	Parameter
101	DIAG_LEVEL
102	HYS_STELL_Y
103	STEPSTART
104	STEPEND
105	STEP_SAMPLE_RATE
106	ERRORBYTE
107	RAMP_UP
108	RAMP_DOWN
109	LATENCY_AFTER_STEP
110	STEP_SELECTION
111	AUTOSTART
112	OVERSHOOT_RISING
113	OVERSHOOT_FALLING
114	DEAD_TIME_RISING
115	DEAD_TIME_FALLING
116	TIME_63_RISING
117	TIME_63_FALLING
118	TIME_98_RISING
119	TIME_98_FALLING
120	STEP_PROGRESS

Analog Output Function Block

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
ALERT_KEYS	**4**	S	r/w	ALL	1 to 255, [0] "0" is not a permissible value and will be rejected when transferring data to the device (error alarm).
BKCAL_OUT	**25**	D	r		
BLOCK_ALM	**30**	D	r		
BLOCK_ERR	**6**	D	r		OUT OF SERVICE . . . . CONFIGURATION_ERROR . . . . INPUT FAILURE PV . . . . OUTPUT FAILURE . . . .
CAS_IN	**17**	N	r/w	ALL	
CHANNEL	**22**	S	r/w	O	[3]
FSTATE_TIME	**23**	S	r/w	ALL	[0]
FSTATE_VAL	**24**	S	r/w	ALL	Value and range of PV_SCALE ±10 %, [0]
GRANT_DENY	**13**	D	r/w	NA	

Description
Used to specify the identification number of the plant section. This information can be used by the fieldbus host system to group alert and events.
Reflects the analog output value and its status required by the BKCAL_IN parameter of the upstream Function Block for cascade control. This value provides windup protection in the upstream block and a bumpless transfer on mode changes.
Indicates the current block state with details on all configuration, hardware or system problems in the block including date and time stamp.
Reflects the active errors associated with a block. . . Block mode is out of service. . . A configuration error exists in the block. . . Position feedback has bad status, e.g. because the Transducer Block is in O/S mode. . . OUT cannot be issued, e.g. because the Transducer Block is not initialized or is in LO mode.
Reflects/defines the analog reference variable and its status from an upstream function block.
Assignment between the output of each Analog Output Function Block and the logical hardware channels (Transducer Block) **Note:** In order to be able to put the AO Function Block into operation, CHANNEL must be set to a valid value. The valid value is 3 in this case as there are three Transducer Blocks (Standard Advanced Positioner Valve) in the Type 3730-5.
The length of time, in seconds, that the AO Function Block will wait to set Fault State after the recognition of an error of the valid set point. The Fault State is triggered when the fault still exists after the time interval has elapsed. **Note:** The Fault State of the AO Function Block is set in the IO_OPTS parameter of this block.
Determines the set point for the AO Function Block when the Fault State is triggered. **Note:** This value is used when the option “Fault State to value” is set in the IO_OPTS parameter.
Grants or denies access of a fieldbus host system to the field device. **Note:** This parameter is not used by Type 3730-5.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
IO_OPTS	**14**	S	r/w	O	SP-PV Track in MAN . . . . Track in LO. . . . . SP Track retained target . . . . Increase to close . . . . Fault State to value . . . . Use Fault State Value on restart . . . . Target to MAN if Fault State activated . . . . Use PV for BKCAL_OUT. . . . .
MODE_BLK	**5**	N	r/w	ALL	O/S . . . . MAN . . . . AUTO . . . . CAS . . . . RCAS . . . .
OUT	**9**	N	r/w	M/O	Range of OUT_SCALE ±10 % Unit from XD_SCALE parameter group
PV	**7**	D	r		Unit from XD_SCALE parameter group
PV_SCALE	**11**	S	r/w	O	0 to 100 %
RCAS_IN	**26**	N	r/w	ALL	

Description

Used to select how the input/output is processed in the AO Block

. . The set point tracks the process variable in MAN mode (ACTUAL_MODE) SP-PV

. . The set point tracks the process variable in LO mode (ACTUAL_MODE)

. . The set point tracks RCAS_IN or CAS_IN depending on the set TARGET_MODE in LO or MAN mode (ACTUAL_MODE). This option has priority over SP_PV Track in MAN/LO mode.

. . The output value to the Transducer Block is inverted (same as direction of action).

. . FSTATE_VAL is used as the set point when the Fault State is triggered (see FSTATE_VAL, FSTATE_TIME).

. . FSTATE_VAL is used for the set point until there is a valid value on restarting the device.

. . On triggering the Fault State, the TARGET_MODE is set to MAN. The original target mode is lost as a result. After leaving the Fault State, the block remains in MAN and must be set to the required target mode by the user.

. . The process variable is used instead of the working set point in BKCAL_OUT. If OUT READBACK is set in the FEATURES_SEL parameter in the Resource Block, the current valve position is reported back over BKCAL_OUT.

Indicates the actual mode of the AO Block as well as the target and permitted modes supported by the AO Block and the normal mode.

. . The AO algorithm of the block is not processed. The last value is issued at OUT or the determined value when the Fault State is activated.

. . The user can directly determine the output value of the AO Block.

. . The set point determined by the user is used over the SP parameter on implementation of the AO Block.

. . The AO Function Block receives the reference variable directly from an upstream function block over the CAS_IN parameter to calculate the manipulated variable internally. The AO Block is implemented.

. . The AO Function Block receives the reference variable directly from the host system over the RCAS_IN parameter to calculate the manipulated variable internally. The AO Block is implemented.

Indicates the manipulated variable, value, limit, and status of the AO Function Block.

Note: The output value OUT can be set manually if the MAN mode is selected in MODE_BLK..

Indicates the process variables including their status used for implementation of the function block.

Note: If OUT READBACK is set in the FEATURES_SEL parameter in the Resource Block, PV contains the current valve position (same as FINAL_POSITION_VALUE).

Definition of the range (initial and final values), the engineering unit and the number of decimal places used for the process variables (PV).

Input and display of the analog reference variable (value and status) provided by the fieldbus host system for internal calculation of the manipulated variable.

Note: This parameter is only active in the RCAS mode.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
RCAS_OUT	**28**	D	r		
READBACK	**16**	D	r		Value determined from FINAL_POSITION_ VALUE parameter of the associated Transducer Block. Unit from XD_SCALE parameter group
SHED_OPT	**27**	S	r/w	ALL	[Uninitialized] . . . . NormalShed_NormalReturn. . . . . NormalShed_NoReturn . . . . ShedToAuto_NormalReturn . . . . ShedToAuto_NoReturn . . . . ShedToManual_NormalReturn . . . . ShedToManual_NoReturn . . . . ShedToRetainedTarget_NormalReturn . . . . ShedToRetainedTarget_NoReturn . . . .
SIMULATE	**10**	D	r/w	ALL	
SP	**8**	N	r/w	O/M/A	Value and range from PV_SCALE ±10 % Unit from PV_SCALE
SP_HI_LIM	**20**	S	r/w	ALL	Value and range from PV_SCALE ±10 %, [100]
SP_LO_LIM	**21**	S	r/w	ALL	Value and range from PV_SCALE ±10 %, [0]

Description

Display of analog reference variable (value and status) after ramping.

This value is provided to the fieldbus host system for back calculation to allow action to be taken under mode changes or limited signals.

Note: This parameter is only active in the RCAS mode.

Reflects current valve position.

Determines what action is to be taken when the monitoring time is exceeded (see SHED_RCAS parameter in the Resource Block) while the connection between the fieldbus host system and the AO Block in RCAS mode is being checked. When the time has elapsed, the AO Block switches from RCAS mode to the mode selected in SHED_OPT. The action to be taken after the Fault State ends is also determined.

Note: This parameter is only active in RCAS mode in the AO Block. The AO Block cannot be set to the RCAS mode when the value is set to Uninitialized.

. . Not inititialized

. . On failure of remote connection, change to next possible mode until RCAS mode is restored.

. . On failure of remote connection, change to next possible mode. The block remains in this mode.

. . On failure of remote connection, change to AUTO mode until RCAS mode is restored.

. . On failure of remote connection, change to AUTO mode. No attempt is made to restore the mode and the block remains in AUTO mode.

. . On failure of remote connection, change to MAN mode until RCAS mode is restored.

. . On failure of remote connection, change to MAN mode. No attempt is made to restore the mode and the block remains in MAN mode.

. . On failure of remote connection, the block attempts to attain the retained target mode until RCAS mode is restored.

. . On failure of remote connection, the block sets the target mode to the retained target mode.

The value and status of process variable PV of the block are simulated.

Note: During the simulation, the OUT value is not passed on to the Transducer Block. It keeps the last value valid prior to activating the simulation. The simulation can only be activated if the Simulation Enable hardware switch is set in the device (see also Resource Block).

Used to enter the set point (reference variable) in AUTO mode.

Used to enter the upper limit of the set point (reference variable).

Note: This value must be adapted correspondingly if the scale end setting is changed in PV_SCALE parameter.

Used to enter the lower limit of the set point (reference variable).

Note: This value must be adapted correspondingly if the scale end setting is changed in PV_SCALE parameter.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
SP_RATE_DN	**18**	S	r/w	ALL	[3402823466 x 10^{38}]
SP_RATE_UP	**19**	S	r/w	ALL	[3402823466 x 10^{38}]
ST_REV	**1**	N	r		
STATUS_OPTS	**15**	S	r/w	O	[Uninitialized]. . . . . Propagate Fault Backward . . . .
STRATEGY	**3**	S	r/w	ALL	[0]
TAG_DESC	**2**	S	r/w	ALL	[No text], max. 32 characters
UPDATE_EVT	**29**	D	r		
XD_SCALE	**12**	S	r/w	O	0.0 to 100.0 % Specified in [%], [mm] or [degrees]

Parameter index

Index	Parameter
0	–
1	ST_REV
2	TAG_DESC
3	STRATEGY
4	ALERT_KEYS
5	MODE_BLK

Index	Parameter
6	BLOCK_ERR
7	PV
8	SP
9	OUT
10	SIMULATE
11	PV_SCALE

Index	Parameter
12	XD_SCALE
13	GRANT_DENY
14	IO_OPTS
15	STATUS_OPTS
16	READBACK
17	CAS_IN

Description

Used to enter the ramp rate for downward set point changes in AUTO mode.

Note: The set point is used immediately when the ramp rate is set to zero. The rate limit is active for output blocks in the AUTO and CAS modes.

Used to enter the ramp rate for upward set point changes in AUTO mode.

Note: The set point is used immediately when the ramp rate is set to zero.

Indicates the revision state of static data.

Note: The revision state is incremented by one each time a static parameter in the block is written.

Allows the selection of status options available to determine the handling and processing of the status.

. . Not initialized

. . Status of the Transducer Block is passed on to the upstream block over the status of BKCAL_OUT.

Permits strategic grouping and thus faster processing of blocks. Blocks are grouped by entering the same number in the STRATEGY parameter of each block.

Note: These data are neither checked nor processed by the AO Function Block.

Assigns a unique description to each block for clear identification.

Indicates that static data were changed, including date and time stamp.

Definition of the range (initial and final values), the engineering unit and the number of decimal places used to display the manipulated variable (OUT).

Note: When [%] is used, the OUT value is based on a scale of 100 %. In case of [mm] (with globe valves) or [degrees] (with rotary valves), the OUT value corresponds to the value set in the RATED_TRAVEL parameter in the Transducer Block which is scaled as 100 %.

Index	Parameter
18	SP_RATE_DN
19	SP_RATE_UP
20	SP_HI_LIM
21	SP_LO_LIM
22	CHANNEL
23	FSTATE_TIME

Index	Parameter
24	FSTATE_VAL
25	BKCAL_OUT
26	RCAS_IN
27	SHED_OPT
28	RCAS_OUT
29	UPDATE_EVT

Index	Parameter
30	BLOCK_ALM

Discrete Input Function Block 1

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
ACK_OPTION	**21**	S	r/w	O/M/A	[0] . . . . No selection BLOCK_ALM . . Block alarm DISC_ALM . . . . Discrete alarm
ALARM_SUM	**20**	S/D	r/w	O/M/A	BLOCK_ALM . . Block alarm DISC_ALM . . . . Discrete alarm
ALERT_KEY	**4**	S	r/w	O/M/A	1 to 255, [0] “0” is not a permissible value and will be rejected when transferring data to the device (error alarm).
BLOCK_ALM	**19**	D	r		
BLOCK_ERR	**6**	D	r		OUT OF SERVICE . . . . CONFIGURATION_ERROR . . . .
CHANNEL	**15**	S	r/w	O	[1] to 3
DISC_ALM	**24**	D	r		
DISC_LIM	**23**	S	r/w	O/M/A	[0], 1
DISC_PRI	**22**	S	r/w	O/M/A	[0] . . . . 1 . . . . 2 . . . . 3 to 7 . . . . 8 to 15 . . . .
IELD_VAL_D	**17**	N	r		
GRANT_DENY	**12**	D	r/w	NA	
IO_OPTS	**13**	S	r/w	O	INVERT . . . .

Description
Determines whether an alarm is to be automatically acknowledged in the positioner, i.e. without intervention of the fieldbus host system. **Note:** The alarm is broadcast to the fieldbus host system, but not acknowledged by it.
Determines the current status of the process alarms in the DI1 Function Block **Note:** The process alarms can also be deactivated in this parameter group.
Used to specify the identification number of the plant section. This information can be used by the Fieldbus host system to group alert and events.
Indicates the current block state with details on all configuration, hardware or system problems in the block including date and time stamp.
Reflects the active errors associated with a block. . . Block mode is out of service. . . A configuration error exists in the block.
Determines which Transducer Block is assigned to the DI1 Function Block.
Indicates the status of the discrete alarm including details on the time of the alarm (time and date stamp) and on the value which triggered the alarm. The value entered in DISC_LIM is exceeded. **Note:** In addition, an active block alarm can be acknowledged manually in this parameter group.
The state of the discrete input that causes the alarm.
Determines the action to be taken when the value entered in DISC_LIM is reached. . . The limit violation is not processed. . . Alarm is not broadcast to fieldbus host system. . . Reserved for block alarms . . Low limit alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high). . . High limit alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high).
Indicates the discrete input value of the DI1 Function Block with details on the status.
Grants or denies access of a fieldbus host system to the field device. **Note:** This parameter is not processed by Type 3730-5.
Used to select how the input/output is processed in the DI1 Block. . . Used to logically invert the value of FIELD_VAL_D before it is stored as OUT_D.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
MODE_BLK	5	N	r/w	O/M/A	AUTO . . . . MAN . . . . O/S . . . .
OUT_D	8	N	r/w	O/M	
PV_D	7	D	r		
PV_FTIME	16	S	r/w	O/M/A	[0]
SIMULATE_D	9	S	r/w	O/M/A	
STATUS_OPTS	14	S	r/w	O	[Uninitialized] Propagate Fail Fwd
STRATEGY	3	S	r/w	O/M/A	[0]
ST_REV	1	N	r		
TAG_DESC	2	S	r/w	O/M/A	[No text], max. 32 characters
UPDATE_EVT	18	D	r		

Parameter index

Index	Parameter
0	–
1	ST_REV
2	TAG_DESC
3	STRATEGY
4	ALERT_KEY

Index	Parameter
5	MODE_BLK
6	BLOCK_ERR
7	PV_D
8	OUT_D
9	SIMULATE_D

Index	Parameter
10	–
11	–
12	GRANT_DENY
13	IO_OPTS
14	STATUS_OPTS

Description
Indicates the actual mode of the DI1 Block, the permitted modes supported by the DI1 Block, and the normal mode. . . The binary input value FIELD_VAL_D is processed by the Function Block and issued as OUT_D. . . The user can directly enter the output value of the Function Block over OUT_D. . . The DI algorithm of the block is not processed. The last value is issued at OUT_D.
Indicates/defines the discrete output value of the DI1 Block with the associated status.
Indicates the discrete state used for the Function Block with status. The parameter is identical to the OUT_D in AUTO mode.
Used to enter the filter time constant (in seconds) of the digital filter until a binary state at the input of the function block is adopted in the PV_D parameter.
A discrete input value FIELD_VAL_D can be simulated with status. **Note:** The simulation can only be activated when this has been enabled at the field device (Code 48/FF-P/F03) as well as in the Function Block.
Allows the selection of status options available to determine the handling and processing of the status.
Permits strategic grouping and thus faster processing of blocks. Blocks are grouped by entering the same number in the STRATEGY parameter of each block. **Note:** These data are neither checked nor processed by the DI Function Block.
The revision state of static data is displayed. **Note:** The revision state will be incremented each time a static parameter in the block is changed.
Assigns a unique description to each block for clear identification.
Indicates whether static block data have been changed, including date and time stamp.

Index	Parameter
15	CHANNEL
16	PV_FTIME
17	FIELD_VAL_D
18	UPDATE_EVT
19	BLOCK_ALM

Index	Parameter
20	ALARM_SUM
21	ACK_OPTION
22	DISC_PRI
23	DISC_LIM
24	DISC_ALM

PID Function Block

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
ACK_OPTION	**46**	S	r/w	ALL	[Undefined] . . . . HI_HI_ALM . . . . HI_ALM . . . . LO_LO_ALM . . . . LO_ALM . . . . DV_HI_ALM . . . . DV_LO_ALM . . . . BLOCK ALM . . . .
ALARM_HYS	**47**	S	r/w	ALL	0 to 50 %, [0.5 %]
ALARM_SUM	**45**	S/D	r/w	ALL	HI_HI_ALM . . . . HI_ALM . . . . LO_LO_ALM . . . . LO_ALM . . . . DV_HI_ALM . . . . DV_LO_ALM . . . . BLOCK ALM . . . .
ALERT_KEY	**4**	S	r/w	ALL	1 to 255, [0] "0" is not a permissible value and will be rejected when transferring data to the device (error alarm)
BAL_TIME	**25**	S	r/w	ALL	[0]

Description

Used to select whether an alarm is to be automatically acknowledged in the positioner, i.e. without intervention of the Fieldbus host system.

Note: The alarm is broadcast to the fieldbus host system, but not acknowledged by it.

. . . No selection

. . . High high alarm

. . . High alarm

. . . Low low alarm

. . . Low alarm

. . . Deviation high alarm

. . . Deviation low alarm

. . . Block alarm

Used to specify the amount the alarm value must return to within the alarm limit before the associated active alarm condition clears. The hysteresis value affects the following alarms of the PID Function Block:
HI_HI_LIM; HI_LIM; LO_LO_LIM; LO_LIM; DV_HI_LIM; DV_LO_LIM

Note: The hysteresis value is based upon the percent of the range of the PV_SCALE parameter group in the PID Function Block.

Indicates the current status of the process alarm in the PID Function Block.

Note: The process alarms can also be deactivated in this parameter group.

. . High high alarm

. . High alarm

. . Low low alarm

. . Low alarm

. . Deviation high alarm

. . Deviation low alarm

. . Block alarm

Used to specify the identification number of the plant section.

This information can be used by the fieldbus host system to group alert and events.

Used to specify the time constant at which the integral term will move to obtain balance (calculated manipulated variable > OUT_HI_LIM or < OUT_LO_LIM)

Note: Balance is immediately obtained when the value 0 (initial value) is set.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
BKCAL_HYS	**30**	S	r/w	ALL	0 to 50 %, [0.5 %]
BKCAL_IN	**27**	N	r/w	ALL	
BKCAL_OUT	**31**	D	r		
BLOCK_ALM	**44**	D	r/w	ALL	
BLOCK_ERR	**6**	D	r		OUT OF SERVICE . . . . CONFIGURATION_ERROR . . . .
BYPASS	**17**	S	r/w	M/O	Uninitialized . . . . [OFF] . . . . ON . . . .
CAS_IN	**18**	N	r/w	ALL	
CONTROL_OPTS	**13**	S	r/w	O	[None] Bypass Enable . . . . Direct Acting. . . . . Track Enable. . . . . Track in Manual . . . . PV for BKCAL_OUT. . . . . No OUT Limits in Manual . . . .

Description

Used to specify the amount the manipulated variable must change away from its range limits OUT_HI_LIM and OUT_LO_LIM before the limit status is turned off.

If the manipulated variable moves off a limit, in percent of scale, the limit status is indicated in the OUT parameter and passed on to the following blocks.
The range limit status remains active as long as the value of the manipulated variable does not move off the limits again.

Indicates the analog input value and status from the BKCAL_OUT parameter of a downstream function for a cascade control.

This value provides a bumpless transfer on mode changes by backward output tracking.

Reflects the analog output value and status required by the BKCAL_IN parameter of the upstream function block for a cascade control.

This value provides windup protection in the upstream block and a bumpless transfer on mode changes.

Indicates the current block state with information about configuration, hardware, or system failure including details on the time of the alarm (time and date stamp).

Reflects the active errors associated with a block.

. . The block mode is out of service.

. . A configuration error exists in the block.

Used to activate or deactivate the calculation of the manipulated variable using the PID control algorithm.

Note: When "Uninitialized" is set, the block remains in O/S mode. To activate the bypass (set to ON), the bypass must be enabled in the options (CONTROL_OPTS parameters).

. . Same as ON

. . Bypass deactivated: The manipulated variable determined using the PID control algorithm is issued over the OUT parameter.

. . BYPASS activated: The value of the reference variable SP is issued directly over the OUT parameter.

Used to indicate/define the analog reference variable and its status from an upstream function block.

Allows selection of controller options available to determine the automation strategy.

. . Enable BYPASS parameter

. . Direct action

. . Enable tracking

. . Tracking in MAN mode

. . Value and status of PV parameter used for BKCAL_OUT parameter

. . No output limits in MAN mode

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
DV_HI_ALM	**64**	D	r/w	ALL	
DV_HI_LIM	**57**	S	r/w	ALL	[3402823466 x 10^{38}]
DV_HI_PRI	**56**	S	r/w	ALL	[0] . . . . 1 . . . . 2 . . . . 3 to 7. . . . . 8 to 15. . . . .
DV_LO_ALM	**65**	D	r		
DV_LO_LIM	**59**	S	r/w	ALL	[-3402823466 x 10^{38}]
DV_LO_PRI	**58**	S	r/w	ALL	[0] . . . . 1 . . . . 2 . . . . 3 to 7. . . . . 8 to 15. . . . .
FF_GAIN	**42**	S	r/w	M/O	[0]
FF_SCALE	**41**	S	r/w	M/O	[0 to 100 %]
FF_VAL	**40**	N	r/w	ALL	Range and unit from FF_SCALE
GAIN	**23**	S	r/w	ALL	[1.0]

Description
Indicates deviation high alarm status including details of time of alarm (date and time stamp) as well as the value that triggered the alarm. The controlled variable exceeds the reference variable by more than the value determined in DV_HI_LIM parameter.
The setting for the alarm limit used to detect the deviation high alarm condition. If the controlled variable exceeds the reference variable by this value, the DV_HI_ALM is issued.
Determines the action to be taken when the value for the deviation high alarm is exceeded (DV_HI_LIM). . . The limit for deviation high alarm is not processed. . . Alarm is not broadcast to fieldbus host system. . . Reserved for block alarms . . Deviation high alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high). . . Deviation high alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high).
Indicates deviation low alarm status including details of time of alarm (date and time stamp) as well as the value that triggered the alarm. The controlled variable does not reach the reference variable by more than the value determined in DV_LO_LIM parameter. **Note:** In addition, an active alarm can be acknowledged manually in this parameter group.
The setting for the alarm limit used to detect the deviation low alarm condition. If the controlled variable does not reach the reference variable by this value, the DV_LO_ALM is issued.
Determines the action to be taken when the value for the deviation low alarm is not reached (DV_LO_LIM). . . The limit for deviation low alarm is not processed. . . Alarm is not broadcast to fieldbus host system . . Reserved for block alarms. . . Deviation low alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high). . . Deviation low alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high)
Used to input the gain of the manipulated variable. **Note:** The gain is multiplied with the feedforward input (FF_VAL) and the result added to the OUT value.
Defines the measuring range (upper and lower limits), the engineering unit and the number of decimal places used for the feedforward input (FF_VAL).
Indicates/specifies the value and status of the feedforward input. **Note:** The feedforward input is multiplied with the gain (FF_GAIN) and the result added to the OUT value.
Specifies the proportional gain (factor). **Note:** The parameter must be set to a value other than 0, otherwise a configuration error will be set in the BLOCK_ERR parameter and the block will go to O/S mode.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
GRANT_DENY	**12**	D	r/w	NA	
HL_ALM	**61**	D	r		Unit from PV_SCALE
HI_HI_ALM	**60**	D	r/w		Unit from PV_SCALE
HI_HI_LIM	**49**	S	r/w	ALL	Range and unit from PV_SCALE, [3402823466 x 10^{38}]
HI_HI_PRI	**48**	S	r/w	ALL	[0] . . . . 1 . . . . 2 . . . . 3 to 7. . . . . 8 to 15. . . . .
HI_LIM	**51**	S	r/w	ALL	Range and unit from PV_SCALE, [3402823466 x 10^{38}]
HI_PRI	**50**	S	r/w	ALL	0 . . . . 1 . . . . 2 . . . . 3 to 7. . . . . 8 to 15. . . . .
IN	**15**	N	r/w	ALL	
LO_ALM	**62**	D	r		Unit from PV_SCALE
LO_LIM	**53**	S	r/w		Range and unit from PV_SCALE, [-3402823466 x 10^{38}]
LO_LO_ALM	**63**	D	r		Unit from PV_SCALE
LO_LO_LIM	**55**	S	r/w	ALL	Range and unit from PV_SCALE, [-3402823466 x 10^{38}]

Description
Grants or denies access of a fieldbus host system to the field device. **Note**: This parameter is not used by Type 3730-5.
Indicates high alarm status (HI_LIM) including details of time of alarm (date and time stamp) as well as the value that triggered the alarm.
Indicates high high alarm status (HI_HI_LIM) including details of time of alarm (date and time stamp) as well as the value that triggered the alarm. **Note:** The active alarm can also be acknowledged manually in this parameter group.
The setting for the alarm limit used to detect the high high alarm (HI_HI_ALM) condition. If the PV value exceeds this limit, the HI_HI_ALM is issued.
Determines the action to be taken when the value for the high high alarm is exceeded (HI_HI_LIM). . . The limit for high high alarm is not processed. . . Alarm is not broadcast to fieldbus host system. . . Reserved for block alarms . . High high alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high). . . High high alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high).
The setting for the alarm limit used to detect the high alarm (HI_ALM) condition. If the PV value exceeds this limit, the HI_ALM is issued.
Determines the action to be taken when the value for the high alarm is exceeded (HI_LIM). . . The limit for high alarm is not processed. . . Alarm is not broadcast to fieldbus host system. . . Reserved for block alarms . . High alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high). . . High alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high).
Indicates/specifies the analog input variable with details on state and value.
Indicates low alarm status (LO_LIM) including details of time of alarm (date and time stamp) as well as the value that triggered the alarm.
The setting for the alarm limit used to detect the low alarm (LO_ALM) condition. If the PV value exceeds this limit, the LO_ALM is issued.
Indicates low low alarm status (LO_LO_LIM) including details of time of alarm (date and time stamp) as well as the value that triggered the alarm. **Note:** The active alarm can also be acknowledged manually in this parameter group.
The setting for the alarm limit used to detect the low low alarm (LO_LO_ALM) condition. If the PV value falls below this limit, the LO_LO_ALM is issued.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
LO_LO_PRI	**54**	S	r/w	ALL	 [0] . . . . 1 . . . . 2 . . . . 3 to 7 . . . . 8 to 18 . . . .
LO_PRI	**52**	S	r/w	ALL	 [0] . . . . 1 . . . . 2 . . . . 3 to 7 . . . . 8 to 15 . . . .
MODE_BLK	**5**	S	r/w	ALL	 O/S . . . . MAN . . . . AUTO . . . . CAS . . . . RCAS . . . . ROUT . . . .
OUT	**9**	N	r/w	O/M	Range OUT_SCALE ±10 %, Unit from XD_SCALE
OUT_HI_LIM	**28**	S	r/w	ALL	Range OUT_SCALE ±10 %, Unit from OUT_SCALE, [100]
OUT_LO_LIM	**29**	S	r/w	ALL	Range OUT_SCALE ±10 %, Unit from OUT_SCALE, [0]
OUT_SCALE	**11**	S	r/w	O	[0 to 100 %]
PV	**7**	D	r		Unit from PV_SCALE

Description

Determines the action to be taken when the value for the low low alarm is not reached (LO_LO_LIM).
. . The limit for low low alarm is not processed.
. . Alarm is not broadcast to fieldbus host system.
. . Reserved for block alarms.
. . Low low alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high).
. . Low low alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high).

Determines the action to be taken when the value for the low alarm is not reached (LO_LIM).
. . The limit for low alarm is not processed.
. . Alarm is not broadcast to fieldbus host system.
. . Reserved for block alarms.
. . Low alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high).
. . Low alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high).

Indicates the actual mode of the PID Block, the target and permitted modes supported by the PID Block, and the normal mode.
. . The PID algorithm of the block is not implemented. The last value or the value determined when the Fault State is activated is issued at OUT parameter.
. . The output value of the block can directly be entered by the user over the OUT parameter.
. . The set point determined by the user is used to implement the PID Block over the SP parameter.
. . The PID Function Block receives the reference variable directly from an upstream function block over the CAS_IN parameter for internal calculation of the manipulated variable. The AO Block is implemented.
. . The AO Function block receives the reference variable directly from the fieldbus host system for internal calculation of the manipulated variable. The AO Block is implemented.
. . The PID Function Block receives the manipulated variable directly from the fieldbus host system over the ROUT_IN parameter. The manipulated variable is issued again over OUT without the internal PID algorithm being implemented.

Indicates the manipulated variable, the value, limit, and status of the AO Function Block.
Note: If the MAN mode is selected in the MODE_BLK parameter, the output value OUT can be entered manually.

Specifies the upper limit of the analog manipulated variable (OUT).

Specifies the lower limit of the analog manipulated variable (OUT).

Definition of the range (initial and final values), the engineering unit and the number of decimal places used for the manipulated variable (OUT).

Indicates the process variables used to implement the block including their status.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
PV_FTIME	**16**	S	r/w	ALL	[0 s]
PV_SCALE	**10**	S	r/w	O	[0 to 100 %]
RATE	**26**	S	r/w	ALL	[0 s]
RCAS_IN	**32**	N	r/w	ALL	
RCAS_OUT	**35**	D	r		
RESET	**24**	S	r/w		[3402823466 x 10^{38} (max. possible value])
ROUT_IN	**33**	N	r/w	ALL	
ROUT_OUT	**36**	D	r		

Description
Used to enter the filter time constant (in seconds) of the first-order digital filter. This time is needed to allow a 63 % change of the input IN in the value of PV to become effective.
Definition of the range (initial and final values), the engineering unit and the number of decimal places used for the process variable (PV).
Specifies the time constant for the differential function.
Input and display of the analog reference variable (value and status) provided by the fieldbus host system for internal calculation of the manipulated variable. **Note:** This parameter is only active in the RCAS mode.
Display of analog reference variable (value and status) after ramping. This value is provided to the fieldbus host system for back calculation to allow action to be taken under mode changes or limited signals. **Note:** This parameter is only active in the RCAS mode.
Specifies the time constant for the integral-action function. **Note:** The initial value or 0 deactivates the integral-action function.
Input and display of the manipulated variable (value and status) provided by the fieldbus host system. **Note:** This parameter is only active in the ROUT mode.
Indicates the analog reference variable (value and status) that has been written to the ROUT_IN parameter. This value is provided by the fieldbus host system over this parameter to perform back calculation to allow action to be taken under mode changes or limited signals. **Note:** This parameter is only active in the ROUT mode.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
SHED_OPT	**34**	S	r/w	ALL	[Uninitialized] . . . . NormalShed_NormalReturn. . . . . NormalShed_NoReturn . . . . ShedToAuto_NormalReturn . . . . ShedToAuto_NoReturn . . . . ShedToManual_NormalReturn . . . . ShedToManual_NoReturn . . . . ShedToRetainedTarget_NormalReturn . . . . ShedToRetainedTarget_NoReturn . . . .
SP	**8**	N	r/w	O/M/A	Value and range from PV_SCALE ±10 %
SP_HI_LIM	**21**	S	r/w	ALL	Value and range from PV_SCALE ±10 %, [100]
SP_LO_LIM	**22**	S	r/w	ALL	Value and range from PV_SCALE ±10 %, [0]
SP_RATE_DN	**19**	S	r/w	ALL	[3402823466 x 10^{38}]
SP_RATE_UP	**20**	S	r/w	ALL	[3402823466 x 10^{38}]
ST_REV	**1**	S	r		

Description

Determines what action is to be taken when the monitoring time is exceeded (see SHED_RCAS parameter in the Resource Block) while the connection between the fieldbus host system and the PID Block in RCAS or ROUT mode is being checked. When the time has elapsed, the PID Block switches from RCAS or ROUT mode to the mode selected in SHED_OPT. The action to be taken after the Fault State ends is also determined.

Note! This parameter is only active in RCAS or ROUT mode in the PID Block. The PID Block cannot be set to the RCAS or ROUT mode when the value is set to Uninitialized.

. . On failure of remote connection, change to next possible mode until RCAS or ROUT mode is restored.
. . On failure of remote connection, change to next possible mode the block remains in this mode.
. . On failure of remote connection, change to AUTO mode until RCAS or ROUT mode is restored.
. . On failure of remote connection, change to AUTO mode. No attempt is made to restore the mode and the block remains in AUTO mode.
. . On failure of remote connection, change to MAN mode until RCAS or ROUT mode is restored.
. . On failure of remote connection, change to MAN mode. No attempt is made to restore the mode and the block remains in MAN mode.
. . On failure of remote connection, the block attempts to attain the retained target mode until RCAS or ROUT mode is restored.
. . On failure of remote connection, the block sets the target mode to the retained target mode.

Used to enter the set point (reference variable) in AUTO mode.

Used to enter the high limit of the set point (reference variable).

Note: This value must be adapted correspondingly if the scale end setting is changed in PV_SCALE parameter.

Used to enter the low limit of the set point (reference variable).

Note: This value must be adapted correspondingly if the scale end setting is changed in PV_SCALE parameter.

Used to enter the ramp rate for downward set point changes in AUTO mode.

Note: The set point is used immediately when the ramp rate is set to zero. The rate limit is active for output blocks in the AUTO mode.

Used to enter the ramp rate for upward set point changes in AUTO mode.

Note: The set point is used immediately when the ramp rate is set to zero. The rate limit is active for output blocks in the AUTO mode.

Indicates the revision number of static data.

Note: The revision state is incremented by one each time a static parameter in the block is written.

Parameter	Index	SK	Access	Mode	Selection/display, [initial value]
STATUS_OPT	**14**	S	r/w	O	[Uninitialized] . . . . IFS if Bad IN . . . . IFS if Bad CAS_IN. . . . . Use Uncertain as Good . . . . Target In Manual if Bad IN . . . .
STRATEGY	**3**	S	r/w	ALL	[0]
TAG_DESC	**2**	S	r/w	ALL	max. 32 characters, [no text]
TRK_IN_D	**38**	N	r/w	ALL	
TRK_SCALE	**37**	S	r/w	O/M	[0...100 %]
TRK_VAL	**39**	N	r/w	ALL	
UPDATE_EVT	**43**	D	r		

Parameter index

Index	Parameter
0	–
1	ST_REV
2	TAG_DESC
3	STRATEGY
4	ALERT_KEY
5	MODE_BLK
6	BLOCK_ERR
7	PV
8	SP
9	OUT
10	PV_SCALE

Index	Parameter
11	OUT_SCALE
12	GRANT_DENY
13	CONTROL_OPTS
14	STATUS_OPT
15	IN
16	PV_FTIME
17	BYPASS
18	CAS_IN
19	SP_RATE_DN
20	SP_RATE_UP
21	SP_HI_LIM

Index	Parameter
22	SP_LO_LIM
23	GAIN
24	RESET
25	BAL_TIME
26	RATE
27	BKCAL_IN
28	OUT_HI_LIM
29	OUT_LO_LIM
30	BKCAL_HYS
31	BKCAL_OUT
32	RCAS_IN

Description
Allows the selection of status options available to determine the handling and processing of the status: . . Trigger IFS substate of downstream AO Function Block, of the input value (IN) changes the status to BAD. . . Trigger IFS substate if the external reference variable (CAS_IN) changes the status to BAD. . . The status UNCERTAIN is used as GOOD. . . Reverts to MAN mode if the input value changes the status to BAD.
Permits strategic grouping and thus faster processing of blocks. Blocks are grouped by entering the same number in the STRATEGY parameter of each block. **Note**: These data are neither checked nor processed by the PID Function Block.
Assigns a unique description to each block for clear identification.
Indicates/specifies the discrete input (value and status) which activates the external or output tracking. On activating tracking, the block changes to LO mode. The manipulated variable at OUT adopts the value defined over the input TRK_VAL.
Definition of the range (initial and final values), the engineering unit and the number of decimal places used for external tracking value (TRK_VAL).
Indicates/specifies the analog input value and status from another function block for external tracking function.
Indicates that static data were changed, including date and time stamp.

Index	Parameter
33	ROUT_IN
34	SHED_OPT
35	RCAS_OUT
36	ROUT_OUT
37	TRK_SCALE
38	TRK_IN_D
39	TRK_VAL
40	FF_VAL
41	FF_SCALE
42	FF_GAIN
43	UPDAT_EVT

Index	Parameter
44	BLOCK_ALM
45	ALARM_SUM
46	ACK_OPTION
47	ALARM_HYS
48	HI_HI_PRI
49	HI_HI_LIM
50	HI_PRI
51	HI_LIM
52	LO_PRI
53	LO_LIM
54	LO_LO_PRI

Index	Parameter
55	LO_LO_LIM
56	DV_HI_PRI
57	DV_HI_LIM
58	DV_LO_PRI
59	DV_LO_LIM
60	HI_HI_ALM
61	HI_ALM
62	LO_ALM
63	LO_LO_ALM
64	DV_HI_ALM
65	DV_LO_ALM

18 Dimensions in mm

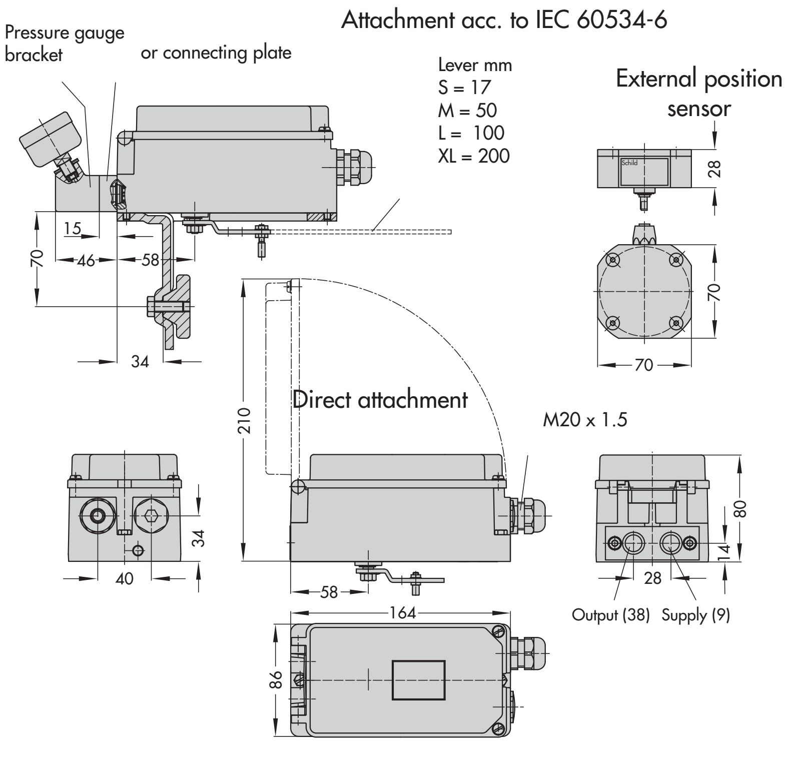
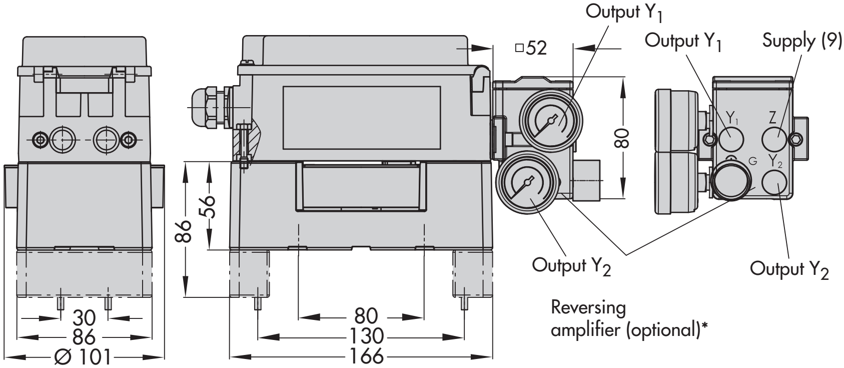
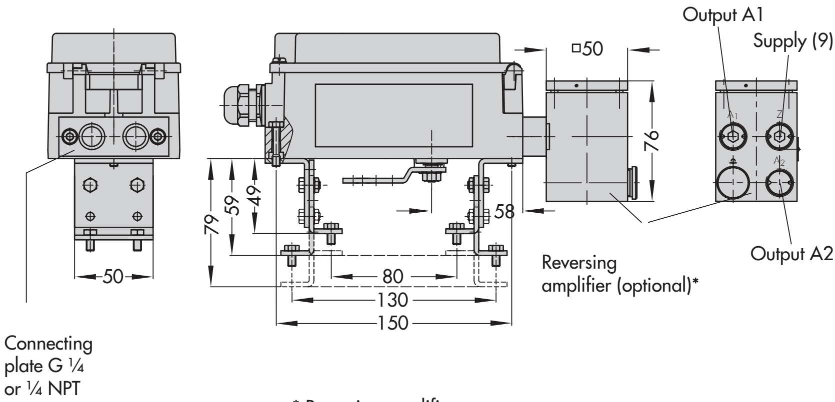


Fig. 29a · NAMUR and direct attachment

Heavy-duty version



Light version



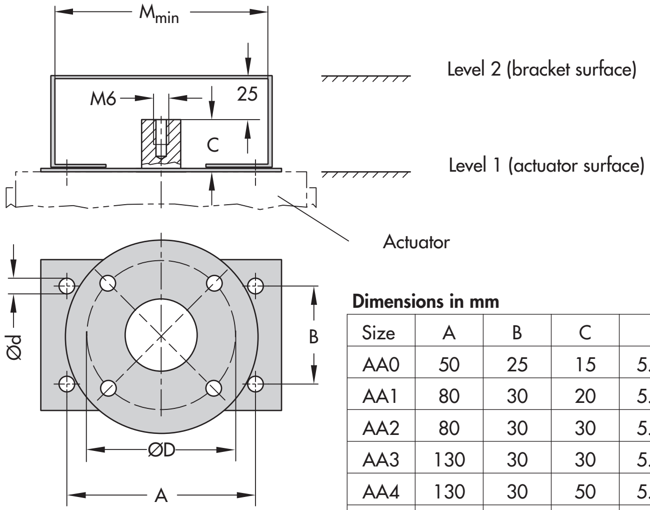
* Reversing amplifier

– Type 3710 (see drawing of heavy-duty version for dimensions)

– 1079-1118/1079-1119, no longer available
(see drawing of light version for dimensions)

Fig. 29b · Attachment to rotary actuators VDI/VDE 3845 (Sept. 2010), fixing level 1, size AA1 to AA4

18.1 Fixing levels according to VDI/VDE 3845 (September 2010)



Dimensions in mm

Size	A	B	C	Ød	M_{min}	ØD*
AA0	50	25	15	5.5 for M5	66	50
AA1	80	30	20	5.5 for M5	96	50
AA2	80	30	30	5.5 for M5	96	50
AA3	130	30	30	5.5 for M5	146	50
AA4	130	30	50	5.5 for M5	146	50
AA5	200	50	80	6.5 for M6	220	50

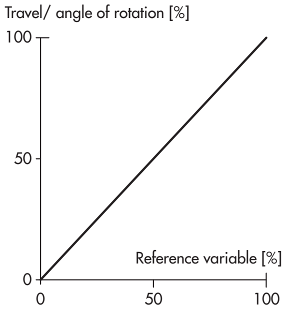
* Flange type F05 according to DIN EN ISO 5211

19 Valve characteristic selection

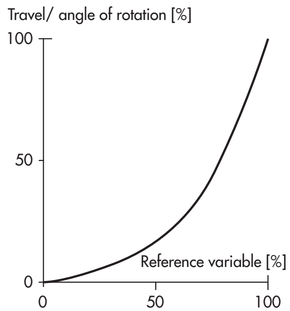
The characteristics that can be selected in Code **20** are shown in following **in graph form**.

Note: *A characteristic can only be defined (user-defined characteristic) using a workstation/ operating software (e.g. TROVIS-VIEW).*

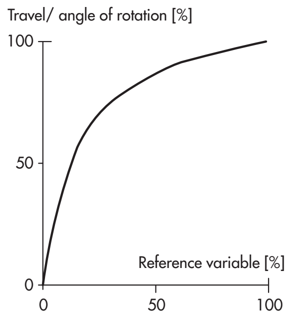
Linear (select characteristic: 0)



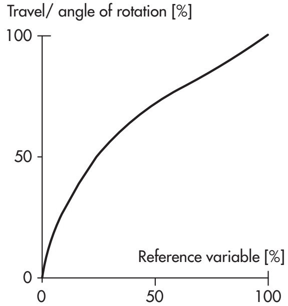
Equal percentage (select characteristic: 1)



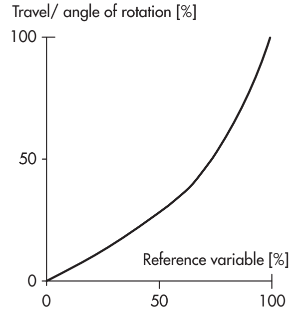
Rev. equal percentage (select characteristic: 2)



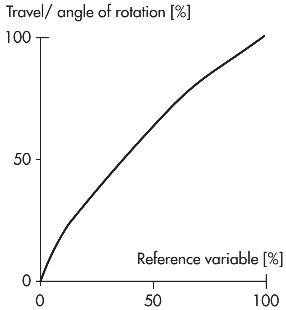
SAMSON butterfly valve linear
(select characteristic: 3)



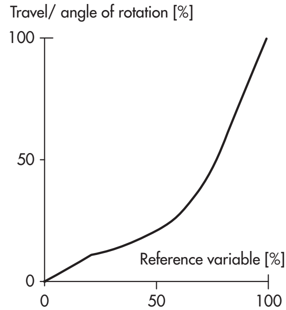
SAMSON butterfly valve equal percentage
(select characteristic: 4)



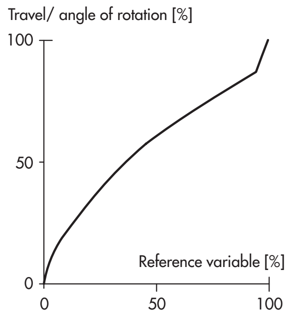
VETEC rotary plug valve linear
(select characteristic: 5)



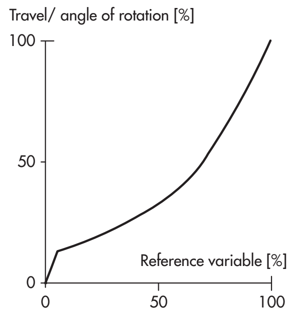
VETEC rotary plug valve equal percentage
(select characteristic: 6)



Segmented valve ball linear
(select characteristic: 7)



Segmented ball valve equal percentage
(select characteristic: 7)



TRANSLATION

Offenbach, 2005-11-21

Your ref.	Your letter	Our ref.	Contact
P. Opl	**2005-11-08**	**479000-9010-0001/67325** **FG33/bhl-wah**	**H. Biehl** **Tel. (069) 8306-249** **Fax (069) 8306-716** **gerhard.biehl@vde.com**

Test report for Information of the Applicant

Testing of the Degree of Protection on enclosures of Type 3730 and Type 3731 Positioners

This test report contains the result of a single investigation carried out on the product submitted. A sample of this product was tested to found the accordance with the thereafter listed standards resp. parts of standards.

The test report does not entitle to use a VDE Certification mark and the *"GS = geprüfte Sicherheit (test safety)"* and does not refer to all VDE specifications applicable to the tested product.

This report may only be passed to a third party in its complete wording including this preamble and the date of issue.

Any publication or reproduction requires the prior written approval of the VDE Testing and Certification Institute.

1 Assignment

The samples described in 2 below were tested for compliance with the IP 66 degree of protection.

2 Samples

2.1 Type 3730 Positioner

2.2 Type 3731 Positioner

3 Basis of assessment

DIN EN 60529/VDE 0470 Part 1/2000-09
Degree of protection provided by enclosures (IP Code)
German version EN 60529:1999+A1:2000

4 Execution of the tests

The dust test had already been carried out on the Type 3730 Positioner under the reference number: 479000-9010-0001/32752 and on the Type 3731 Positioner under the reference number: 479000-9010-0001/58985 with suction as per category 1 at the connecting enclosures of the positioners and solenoid valves. The under pressure was 2 kPa and the test lasted 8 hours.

5 Test results

The testing of the samples described in 2 above yielded the following results:

Protecting against access to hazardous parts and against ingress of solid foreign objects according to DIN EN 60529/VDE 0470 Part 1:2000-09 — **IP6X satisfied**

Protecting against ingress of water according to DIN EN 60529/VDE 0470 Part 1:2000-09 — **IPX6 satisfied**

The positioner enclosures in the versions submitted meet the requirements of IP 66 degree of protection.

There was no ingress of either dust or water.

VDE- Prüf- und Zertifizierungsinstitut
Fachgebiet FG33

(Signature)

(Signature)

Gerhard Biehl

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres
for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.:	**IECEx PTB 06.0054**	Issue No.: **0**
Status:	**Current**	
Date of Issue:	**2006-11-02**	Page **1** of **4**

Applicant: **SAMSON AG Mess- und Regeltechnik**
Weismuellerstrasse 3
D-60314 Frankfurt am Main
Germany

Electrical Apparatus: **Bus-powered field i/p-Positioners types 3730-41 and 3730-51**
Optional accessory:

Type of Protection: **General Requirements, Intrinsic Safety**

Marking: **Ex ia IIC T6**

Approved for issue on behalf of the IECEx Certification Body: Dr.-Ing. Ulrich Johannsmeyer

Position: Department Head of "Intrinsic Safety and Safety of Systems"

Signature:
(for printed version) ____________________

Date: ____________________

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:

Physikalisch-Technische Bundesanstalt (PTB)
Bundesallee 100
38116 Braunschweig
Germany

IECEx Certificate of Conformity

Certificate No.:	**IECEx PTB 06.0054**	
Date of Issue:	**2006-11-02**	Issue No.: **0**
		Page **2** of **4**

Manufacturer: **SAMSON AG Mess- und Regeltechnik**
Weismuellerstrasse 3
D-60314 Frankfurt am Main
Germany

Manufacturing location(s):

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacture's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

STANDARDS:
The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:

IEC 60079-0 : 2004 Edition: 4.0 — Electrical apparatus for explosive gas atmospheres - Part 0: General requirements

IEC 60079-11 : 1999 Edition: 4 — Electrical apparatus for explosive gas atmospheres - Part 11: Intrinsic safety 'i'

*This Certificate **does not** indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.*

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in

Test Report:

DE/PTB/ExTR06.0086/00

Quality Assessment Report:

DE/TUN/QAR06.0011/00

IECEx Certificate of Conformity

Certificate No.: **IECEx PTB 06.0054**

Date of Issue: **2006-11-02**

Issue No.: **0**

Schedule

EQUIPMENT:
Equipment and systems covered by this certificate are as follows:

The Model **3730-41 and 3730-51** i/p-Positioners are bus-powered field devices with communication capability and serve for adjusting the valve stem positions in compliance with a control signal. They are intended for attachment to either linear or rotary actuators.

Communication with field devices programmable logic control systems and distributed control systems is optionally either according to Profibus PA (Model 3730-41 . .), or in accordance with the FOUNDATION™ Fieldbus Specification (Typ 3730-51 . .).

For further information see annexe.

CONDITIONS OF CERTIFICATION: NO

IECEx Certificate of Conformity

Certificate No.: **IECEx PTB 06.0054**

Date of Issue: **2006-11-02**

Issue No.: **0**

Additional information:

for further information see annex

Annexe: 3730-41_51 Technical Data pdf

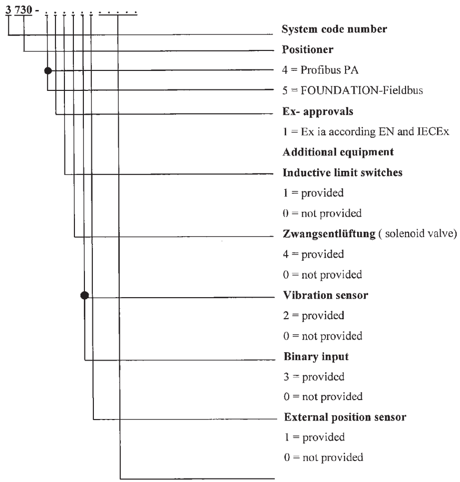
Equipment:	Model 3730-41 Profibus PA Positioner Model 3730-51 FOUNDATION FF Positioner	
Submitted by:	SAMSON AG Mess- und Regeltechnik Weismüllerstrasse 3, 60314 Frankfurt	
Manufactured by:	SAMSON AG Mess- und Regeltechnik Weismüllerstrasse 3, 60314 Frankfurt	
Groups:	**IIC / IIB**	
Type of Protection:	**ia**	
Temperature Classification:.	**T6 / 60°C**	
Degree of Ingress Protection:	**IP 54 IP 65 und IP 66**	

Conditions of Manufacture

Routine testing and high-voltage testing between the individual circuit and the enclosure with 500V, 50Hz, 1min.

Schedule

The positioners come in several versions. The following model designation code applies:



Connections

Pneumatic connections

Electric connections

1+2 = M 20x1,5 (plastic)

5+6 = M 20x1,5 (metal)

The dots in the model designation code will be substituted for numerals identifying the equipment version

Scope

Ex ia IIC/IIB T6 ; -40°C ≤ ta ≤ T6 60°C / -40°C ≤ ta ≤ T5 70°C / -40°C ≤ ta ≤ T4 80°C ; IP 54 or IP 65

"Testing and assessment according IEC 60079-0 and 60079-11" type of protection Ex ia IIC T6 degree of protection IP 54 and IP 65 according to IEC 60529

Table: Summary of results

	FOUNDATION Fieldbus				FISCO			
Group	**IIC**		**IIB**		**IIC**		**IIB**	
U [V]	24		24		20		24	
I [mA]	174(1)	360(2)	433(1)	380(2)	309(1)	360(2)	433(1)	380(2)
P [W]	2,08(1)	1,04(2)	5,16(1)	2,58(2)	3,09(1)	1,54(2)	5,16(1)	2,58(2)

I(1) = maximum current for intrinsically safe resistive circuits according to EN 50020

I(2) = maximum current according to Profibus User Organization

P(1) = maximum power in the intrinsically safe circuit upon matching

P(2) = maximum power in consumer upon matching

Model 3730-41 and 3730-51 i/p Positioners – Permissible maximum values for intrinsic safety according to EG Type Examination Certificate PTB 04 ATEX 2109

The Model 3730-41 and 3730-51 i/p Positioners are bus-powered field devices with communication capability and serve for adjusting the valve stem positions incompliance with a control signal. They are intended for attachment to either linear or rotary actuators.

Communication is optionally either according to Profibus PA in compliance with the FISCO concept (Typ 3730-41) or in accordance with the FOUNDATION™ Fieldbus Specification (Typ 3730-51)

The Model Typ 3730-41 and 3730-51 are passive two-terminal networks which may be connected to all certified intrinsically safe circuits, provided the permissible maximum values of Ui, Ii und Pi are not exceeded.

For instrument air noncombustible media are used.

The equipment is intended for use in hazardous locations.

The correlation between temperature classification and the permissible ambient temperature ranges is shown in the table below:

Temperature class	Permissible ambient temperature ranges
T6	-40 °C ... 60 °C
T5	-40 °C ... 70 °C
T4	-40 °C ... 80 °C

Electrical data

BUS connection signal circuit (terminals 11/12)

Type of protection:
Intrinsic safety Ex ia IIC/IIB
only for connection to an intrinsically safe circuit

The correlation between the type of protection and the electrical data is shown in the tables below:

Maximum values: **Model 3730-4..**

Profibus PA
Ex ia IIC/IIB
Ui = 17,5 V DC
Ii = 380 mA
Pi = 5.32 W

Maximum values: **Model 3730-5..**

FOUNDATION™	
Ex ia IIC	Ex ia IIB
Ui = 24 v DC	Ui = 24 DC
Ii = 360 mA	Ii = 380 mA
Pi = 5.32 W	Pi = 2.58 W

Ci = 5 nF; Li = 10 µH

Limit switch, inductive (terminals 41/42)

Type of protection: Intrinsic safety EEx ia IIC,
only for connection to an intrinsically safe circuit

Maximum values:

Ui = 16 V; Ii = 52 mA;
Pi = 169 mW

Li = 100 µH; Ci = 30 nF

or

Ui = 16 V; Ii = 25 mA:
Pi = 64 mA

Li = 100 µH; Ci = 30 nF

The correlation between temperature classification and the permissible ambient temperature ranges, maximum short-circuit currents and maximum power of the analyzers is shown in the table below:

Temperature classe	Permissible ambient temperature ranges	I_0 / P_0
T6 T5 T4	+45°C -40°C ... +60°C +75°C	52mA / 169mW
T6 T5 T4	+60°C -40°C...+80°C +80°C	25mA / 64mW

Forced venting function (terminals 81/82)

Type of protection: Intrinsic safety Ex ia IIC
only for connection to an intrinsically safe circuit

Maximum values:

Ui = 28 V, Ii = 115 mA
Pi = 500 mW

Li = negligible
Ci = 5.3 nF

Binary input 1 (terminals 87/88)

Type of protection: Intrinsic safety Ex ia IIC/IIB
only for connection to an intrinsically safe circuit

Maximum values:

Ui = 30 V, Ii = 100 mA

Li and Ci = negligible

Binary input 2 (terminals 87/88)

Type of protection: Intrinsic safety Ex ia IIC/IIB
only for connection to an intrinsically safe circuit

Maximum values:

U_0 = 5,88 V, I_0 = 1 mA
P_0 = 7,2 mW

The correlation between the type of protection and the permissible external capacitances and inductances is shown in the table below:

Ex ia IIC	Ex ia IIB
C_0 = 2 µF	C_0 = 4 µF
L_0 = 10 mH	L_0 = 1 H

Li and Ci negligible

Serial interface BU

Type of protection: Intrinsic safety Ex ia IIC

Maximum values:

$U_0 = 8{,}61$ V, $I_0 = 55$ mA
$P_0 = 250$ mW

The correlation between the type of protection and the permissible external capacitances and inductances is shown in the table below

Ex ia IIC	Ex ia IIB
$C_0 = 0{,}61$ µF	$C_0 = 4$ µF
$L_0 = 9$ mH	$L_0 = 9$ mH

Only for connection to a certified intrinsically safe circuit

Maximum values:

$U_i = 16$ V, $I_i = 25$ mA
$P_i = 64$ mW

L_i and C_i negligible

In case of interconnection the rules for interconnecting intrinsically safe circuits shall be complied with.

External position sensor
(analog pcb, pins p9, p10, p11)

Type of protection: Intrinsic safety Ex ia IIC

Maximum values:

$U_0 = 8{,}61$ V, $I_0 = 55$ mA
$P_0 = 250$ mW

The correlation between the type of protection and the permissible external capacitances and inductances is shown in the table below:

Ex ia IIC	Ex ia IIB
$C_0 = 0{,}61$ µF	$C_0 = 4$ µF
$L_0 = 9$ mH	$L_0 = 9$ mH

$L_i = 370$ µH, $C_i = 730$ nF

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

TRANSLATION

(1) **EC TYPE EXAMINATION CERTIFICATION**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – **Directive 94/9/EC**

(3) EC Type Examination Certificate Number

PTB 04 ATEX 2109

(4) Equipment: Model 3730-4.. and 3730-5.. I/P Positioners

(5) Manufacturer: SAMSON AG, Mess- und Regeltechnik

(6) Address: Weismüllerstr. 3, D-60314 Frankfurt, Germany

(7) The equipment and any acceptable variations thereof are specified in the schedule to this certificate.

(8) The Physikalisch-Technische Bundesanstalt, notified body number 0102 in according to Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres as specified in Annex II to the Directive.

The examination and test results are recorded in confidential report PTB Ex 04-24202.

(9) The Essential Health and Safety Requirements are satisfied by compliance with

EN 50014:1997+A1+A2 EN 50020:2002 EN 50281-1-1:1998

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

(11) This EC Type Examination Certificate relates only to the design and examination of the specified equipment in compliance with Directive 94/9/EC Further requirements of this Directive apply to the manufacture and supply of this equipment. These requirements are not covered by this Certificate.

(12) The marking of the equipment shall include the following:

II 2G EEx ia IIC T6 and II 2D IP 65 T 80 °C

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 25 October 2004

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

(13) **S c h e d u l e**

(14) **EC TYPE EXAMINATION CERTIFICATE No. PTB 04 ATEX 2109**

(15) **Description of Equipment**

The Model 3730-4 and 3730-5.. I/P Positioners are bus-powered field devices with communication capability and serve for adjusting valve stem positions in compliance with a control signal. They are intended for attachment to linear or rotary actuators.

Communication is optionally either according to Profibus PA incompliance with the FISCO concept (Model 3730-4..) or in compliance with the FOUNDATION™ Fieldbus Specification (Model 3730-5..)

The Model 3730-4.. and 3730-5.. I/P Positioners are passive two-terminal networks which may be connected to any certified intrinsically safe circuit, provided the permissible maximum values for Ui, Ii and Pi are not exceeded.

For air supply non-combustible media are used.

The devices are intended for use inside the hazardous locations.

The correlation between temperature classification, permissible temperature ranges is shown in the tables below:

Temperature class	Permissible ambient temperature range
T6	-40 °C ... 60 °C
T5	-40 °C ... 70 °C
T4	-40 °C ... 80 °C

Electrical data

BUS connection, signal circuit (terminals 11/12)

Type of protection: Intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit

The correlation between type of protection and the electrical data is shown I the table

Maximum values:
Model 3730-4..

EEx ia IIC/IIB
Ui 17,5 V DC
Ii = 380 mA
Pi = 5.32 W

or
Model 3730-5..

FOUNDATION™	
EEx ia IIC	EEx ia IIB
Ui = 24 v DC	Ui = 24 DC
Ii = 360 mA	Ii = 380 mA
Pi = 5.32 W	Pi = 2.58 W

Ci = 5 nF; Li = 10 μH

Inductive proximity switch (terminals 11/12)

Type of protection. Intrinsic safety EEx ia IIC, only for connection to a certified intrinsically safe circuit

Maximum values

Ui = 16 V
Ii = 52 mA
Pi = 169 mW

Li = 100 μH
Ci = 30 nF

or

Ui = 16 V
Ii = 25 mA
Pi = 64 mA

Li = 100 μH
Ci = 30 nF

The correlation between temperature classification, the permissible ambient temperature ranges, the maximum short-circuit currents and the maximum power for analyzers is shown in the table below

Temperature class	Permissible ambient temperature range	I_0 / P_0
T6	45°C	52mA / 169mW
T5	-40°C …60°C	
T4	75°C	
T6	60°C	25mA / 64mW
T5	-40°C…80°C	
T4	80°C	

Forced venting function (terminals 81/82)

Type of protection: Intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 28 V
I_i = 115 mA
P_i 500 W

L_i = negligible
C_i = 5.3 nF

Binary input 1 (terminals 87 / 88)

Type of protection: Intrinsic safety EEx ia IIC/IIB for connection of an active contact circuit

Maximum values:

U_i = 30 V
I_i = 100 mA

L_i = negligible
C_i = negligible

Binary input 2 (terminals 85 / 86)

Type of protection: Intrinsic safety EEx ia IIC/IIB for connection of an active contact circuit

Maximum values:

U_0 = 5,88 V
I_0 = 1 mA
P_0 = 7,2 mW

The correlation between the type of protection and the permissible maximum allowed capacitances and inductances is shown in the table below

EEx ia IIC	EEx ia IIB
$C_0 = 2\ \mu F$	$C_0 = 4\ \mu F$
L_0 = 10 mH	L_0 = 1 H

C_i = negligible
L_i = negligible

Serial interface BU

Type of protection. intrinsic safety EEx ia IIC

U_0 = 8,61 V
I_0 = 55 mA
P_0 = 250 mW

The correlation between the type of protection and the permissible maximum allowed capacitances and inductances is shown in the table below

EEx ia IIC	EEx ia IIB
$C_0 = 0{,}61\ \mu F$	$C_0 = 4\ \mu F$
L_0 = 9 mH	L_0 = 9 mH

only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 16 V
I_i = 25 mA
P_i = 64 mW

L_i = negligible
C_i = negligible

For interconnection, the rules for interconnecting intrinsically safe circuits shall be complied with

External positioner sensor (analog PCB pins p9, p10, p11)

Type of protection: Intrinsic safety EEx ia IIC

Maximum values:

U_0 = 8,61 V
I_0 = 55 mA
P_0 = 250 mW

The correlation between the type of protection and the permissible maximum allowed capacitances and inductances is shown in the table below

EEx ia IIC	EEx ia IIB
$C_0 = 0{,}61\ \mu F$	$C_0 = 4\ \mu F$
$L_0 = 9$ mH	$L_0 = 9$ mH

$L_i = 370\ \mu H$
$C_i = 730$ nF

(16) Test Report: **PTB Ex 04-24202**

(17) **Special conditions for safe use**

None

(18) **Special Health and Safety Requirements**

In compliance with the standards specified above.

Zertifizierungsstelle Explosionsschutz — Braunschweig, 25 October 2004
By order

(Signature) (seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

TRANSLATION

ADDENDUM No.: 1

in compliance with Directive 94/9/EC Annex III Clause 6
to the EC Type Examination Certificate PTB 04 ATEX 2109

Equipment: Model 3730-41.. and 3730-51

Marking: Ex **II 2G EEx ia IIC T6 and**
Ex **II 2D IP 65 T80°C**

Manufacturer: SAMSON AG Mess- und Regeltechnik

Address: Weismüllerstr. 3, D-60314 Frankfurt, Germany

1. Description of the additions and modifications

The Model 3730-4.. and 3730-5.. are permitted to be manufactured in the future also in compliance with the documents specified in the Test Report. The input wiring of the bus connection circuit has been modified and the pcb layout has been adapted.

The clause below replaces Clause (15) Para. 2 of the EC Type Examination Certificate.

"Bus connection (coupling) can be made according to the FISCO Concept both for the Profibus PA and the Foundation ™ Fieldbus Specification."

The tabular presentation of the electrical data relating to the bus connection signal circuit has been modified:

"BUS connection signal circuit … (Terminals 11/12) — Type of protection EEx ia IIC/IIB only for connection to a certified intrinsically safe circuit.

The interrelationship between type of protection and the electrical data is shown in the table below.

Physikalisch-Technische Bundesanstalt., Bundesallee 100, D-38116 Braunschweig

Physikalisch-Technische Bundesanstalt
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PTB

Addendum No. 1 to the EC Type Examination Certificate PTB 04 ATEX 2109

Maximum values:

Model 3730-4 .. and 3730-5 .. resp.

FISCO supply unit	**BUS supply unit, general**	
EEx ia IIC/IIB	EEx ia IIC	EEx ia IIB
U_i = 17,5 V DC	U_i = 24 V DC	U_i = 24 V DC
I_i = 380 mA	I_i = 360 mA	I_i = 380 mA
P_i = 5,32 W	P_i = 1,04 W	P_i = 2,56 W

C_i = 5 nF
L_i = 10µH

All the other electrical data and other data specified in the EC Type Examination certificate apply also this Amendment No. 1

Test report: **PTB Ex 06-26085**

Zertifizierungsstelle Explosionsschutz — Braunschweig, 13 July 2005
By order

(Signature)
Dr.-Ing. U. Johannsmeyer
Director and Professor
(Seal)

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Ptb47-3730-41/51Add-1.doc

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

T R A N S L A T I O N

A D D E N D U M N o.: 2

in compliance with Directive 94/9/EC Annex III Clause 6
to the EC Type Examination Certificate PTB 04 ATEX 2109

Equipment: Model 3730-4- .. and Model 3730-5 … Positioners

Marking: Ex **II 2 G EEx ia IIC T 6 and**
Ex **II 2 D IP 65 T 80 °C**

Manufacturer: SAMSON AG Mess- und Regeltechnik

Address: Weismüllerstrasse 3
60314 Frankfurt am Main, Germany

Description of the additions and modifications
The Model 3730-4 … and 3730-5.. Positioners are permitted to be manufactured in the future also in compliance with the test documents specified in the Test Report.

The electrical data of the forced ventilation modules of the Models 3730-41 and 3750-51 are modified as follows:

Forced ventilation
only for (terminals 81/82)

Type of protection: Intrinsic Safety EEx ia IIC
connection to a certified intrinsically safe circuit

Maximum values:

U_i	=	28 V
I_i	=	115 mA
L_i		negligible
C_i	=	5,3 nF

All the other electrical data and other data specified in the EC Type Examination Certificate apply also to this Addendum No. 2.

Test report: **PTB Ex 07-27260**

Zertifizierungsstelle Explosionsschutz

By order
(Signature) (Seal)
Dr.-Ing. U. Johannsmeyer
Director and Professor

Braunschweig, 24. August 2007

Page 1 of 1

Physikalisch-Technische Bundesanstalt., Bundesallee 100, D-38116 Braunschweig

Ptb47-3730-41/51Add-2.doc

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

T R A N S L A T I O N

(1) **Statement of Conformity**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – **Directive 94/9/EC**

(3) EC Type Examination Certificate Number

PTB 05 ATEX 2010 X

(4) Equipment: Model 3730-48.. and 3730-58.. Positioners

(5) Manufacturer: SAMSON AG, Mess- und Regeltechnik

(6) Address: Weismüllerstr. 3, D-60314 Frankfurt, Germany

(7) The equipment and any acceptable variations thereof are specified in the schedule to this certificate.

(8) The Physikalisch-Technische Bundesanstalt, notified body number 0102 in according to Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres as specified in Annex II to the Directive.

The examination and test results are recorded in confidential report PTB Ex 05-24319.

(9) The Essential Health and Safety Requirements are satisfied by compliance with

EN 50021:1999 EN 50281-1-1:1998

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

(11) In compliance with the Directive 94/9/EC this Statement of Conformity relates only to the design and construction of the equipment specified. Further requirements of this Directive apply to manufacture and marketing of the equipment.

(12) The marking of the equipment shall include the following:

Ex II 3G EEx nA II T6 or II 3G EEx nL IIC T6 or II 3D IP 54 T 80 °C or II 2D IP 65 T 80 °C

Zertifizierungsstelle Explosionsschutz — Braunschweig, 16 February 2005
By order

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

(13) **S c h e d u l e**

(14) **EC TYPE EXAMINATION CERTIFICATE No PTB 05 ATEX 2010 X**

(15) **Description of Equipment**

The Model 3730-48 and 3730-58.. Positioners are bus-powered field devices with communication capability and serve for translating control signals into valve stem positions. They are intended for attachment to linear or rotary actuators.

For instrument air non-combustible media are used.

The equipment is intended for use inside the hazardous locations.

The correlation between temperature classification, permissible temperature ranges is shown in the tables below:

Temperature class	Permissible ambient temperature range
T6	-40 °C ... 60 °C
T5	-40 °C ... 70 °C
T4	-40 °C ... 80 °C

Electrical data

BUS connection, signal circuit (terminals 11/12)

Type of protection: EEx nA II or Ex nL IIC resp.

Gas group	Maximum values
IIC	U_0 = 20V; I_0 = 464mA, P_0 = 2,32W U_0 = 24V; I_0 = 261mA, P_0 = 1,56W U_0 = 30V; I_0 = 152mA, P_0 = 1,14W
IIB	U_0 20V; I_0 1,17A, P_0 5,88W U_0 = 24V; I_0 = 650mA, P_0 = 3,89W U_0 = 30V; I_0 = 379mA, P_0 = 2,85W

Ci = 5 nF; Li = 10 μH

Physikalisch-Technische Bundesanstalt **PTB**
Braunschweig und Berlin

Inductive proximity switch (terminals 41/42)

Type of protection: EEx nA II or Ex nL IIC resp.

Maximum values

Ui = 20 V
Ii 52 A
Pi 169 W

Li = 100μH
Ci = 30nF

The correlation between temperature classification, the permissible ambient temperature ranges, the maximum short-circuit currents and the maximum power for analyzers is shown in the table below

Temperature class	Permissible ambient temperature range	I_0 / P_0
T6 T5 T4	+45°C -40°C ... +60°C +75°C	52mA / 169mW
T6 T5 T4	+60°C -40°C...+80°C +80°C	25mA / 64mW

Forced venting function (terminals 81/82)

Type of protection: EEx nA II or Ex nL IIC/IIB resp.

Maximum values:

Ui = 30 V
Ii = 100 mA

Li = negligible
Ci = 5.3 nF

Binary input 1 (terminals 87 / 88)

Type of protection: EEx nA II or Ex nL IIC/IIB resp

Maximum values:

Ui = 30 V
Ii = 100 mA

Li = negligible
Ci = negligible

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Binary input 2 (terminals 85 / 86)

Type of protection: EEx nA II or Ex nL IIC/IIB resp.
only for connection of a floating passive contact circuit

Maximum values:

U_0 = 5,88 V
I_0 = 1 mA
P_0 = 7,2 mW

The correlation between the gas group and the permissible maximum allowed capacitances and inductances is shown in the table below

Gas group IIC	Gas group IIB
$C_0 = 1{,}8\mu F$	$C_0 = 15{,}8\mu F$
$L_0 = 9{,}7mH$	$L_0 = 1H$

C_i = negligible
L_i = negligible

Serial interface BU

Type of protection: EEx nA II or Ex nL IIC/IIB resp.

Maximum values (active):

U_0 = 8,61 V
I_0 = 55 mA
P_0 = 250 mW

The correlation between the gas group and the permissible maximum allowed capacitances and inductances is shown in the table below

Gas group IIC	Gas group IIB
$C_0 = 0{,}61\mu F$	$C_0 = 4\mu F$
$L_0 = 9mH$	$L_0 = 9mH$

Maximum values (passive):

U_i = 20V
I_i = 25mA
P_i = 64mW

L_i = negligible
C_i = negligible

External positioner sensor (analog PCB pins p9, p10, p11)

Type of protection: EEx nA II or Ex nL IIC/IIB resp.

Maximum values (active):

U_0 = 8,61 V
I_0 = 55 mA
P_0 = 250 mW

The correlation between the gas group and the permissible maximum allowed capacitances and inductances is shown in the table below

Gas group IIC	Gas group IIB
$C_0 = 0{,}61\mu F$	$C_0 = 4\mu F$
$L_0 = 9mH$	$L_0 = 9mH$

L_i = 370µH
C_i = 730nF

(16) Test Report: **PTB Ex 05-24319**

(17) **Special conditions for safe use**

(18) **Basic safety and health requirements**

In compliance with the standards specified above.

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 16 February 2005

(Signature) (seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

ADDENDUM No. 1

to the Statement of Conformity PTB 05 ATEX 2010 X

Equipment: Model 3730-48.. and 3730-58 Positioners

Marking: Ex **II 3G EEx nA II T6 or** Ex **II 3G EEx nL IIC T6**
Ex **II 3D IP 54 T 80°C or** Ex **II 3D IP 65 T 80°C**

Manufacturer: SAMSON AG Mess- und Regeltechnik

Address: Weismüllerstr. 3
60314 Frankfurt am Main

Description of the additions and modifications

The Model 3730-48.. and 3730-58.Positioners are permitted to be manufactured in the future also in compliance with the documents specified in the Test Report. The input wiring of the bus connection circuit has been modified and the pcb layout has been adapted.

The clause below supplements the description of the equipment under clause (15) Para. 2 of the EC Type Examination Certificate.

"BUS connection (coupling) can be made according to the FISCO Concept both for the Profibus PA and the Foundation ™ Fieldbus Specification."

The electrical data, special conditions and all the other data of the EC Type Examination Certificate continue to apply unaltered also to this Addendum No. 1.

Test report: PTB **Ex 06-26086**

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 13, July 2006

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Director and Professor

Addendum Page 1

Installation Manual for apparatus certified by CSA for use in hazardous locations.
Communication is optionally either according to the **FOUNDATION**^{TM} Fieldbus Specification **or** according to **PROFIBUS PA** in compliance **FISCO-Concept**

The **FISCO Concept** allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criteria for interconnection is that the voltage (**V_{max}**) the current (**I_{max}**) and the power (**P_{max}**) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (**V_{OC}**) the current (**I_{SC}**) and the power (**P_0**) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (**C_i**) and inductance (**L_i**) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to **5 nF** and **10 µH** respectively.
In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system The allowed voltage (**V_{OC}**) of the associated apparatus is limited to the range of
14V DC. to **24V DC**. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50mA for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices need to have the parameters in the following range:

Loop resistance R‘:	15 ... 150 Ohm/km
Inductance per unit length L‘:	0,4 ... 1 mH/km
Capacitance per unit length C‘:	80 ... 200 nF/km

C‘ = C‘ line/line + 0,5 C‘ line/screen, if both lines are floating or, C‘ = C‘ line/line + C’line/screen, if the screen is connected to one line

Length of spur cable:	≤ 30 m
Length of trunk cable:	≤ 1 km

At each end of the trunk cable an approved infallible line termination with the following parameters is suitable:

R = 90 ... 100 Ohm	C = 0 ... 2,2 µF

One of the allowed terminations might already be integrated in the associated apparatus.

The number of passive devices connected to the bus segment is not limited due to I.S. reasons. If the above rules are respected, the inductance and capacitance of the cable will not impair the intrinsic safety of the installation.

Notes:

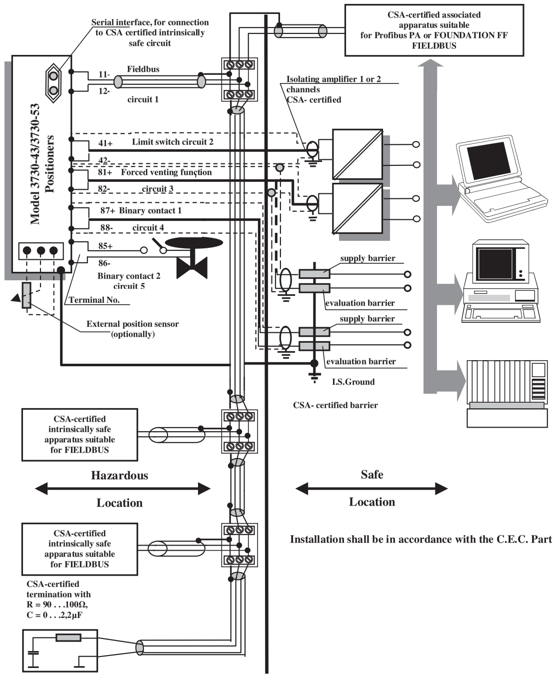
1. Approved associated apparatus must be installed in accordance with manufacturer instructions
2. Approved associated apparatus must meet the following requirements:
   $V_{oc} \leq V_{max}$, $I_{sc} \leq I_{max}$, $P_o \leq P_{max}$
3. The maximum non-hazardous area voltage must not exceed 250 V.
4. The installation must be in accordance with the Canadian Electrical code Part 1.
5. Each set of wires must be provided with grounded shield. The shield must extend as close to the terminal(s) as possible and it must be grounded shield at I. S. Barrier ground.
6. Caution: Use only supply wires suitable for 5 °C above surrounding.
7. Warning: Substitution of components may impair intrinsic safety. PE = I. S. Ground
8. The polarity for connecting 11 and 12 is of no importance due to an internal rectifier.
9. FISCO concept applies to fieldbus / circuit only.
10. Entity parameters apply to circuit 2, 3 and 4 and further required to meet the following conditions:
    $C_o \geq C_i + C_{cable}$; $L_o \geq L_i + L_{cable}$

Addendum Page 2

Intrinsically safe if installed as specified in manufacturer’s installation manual.

CSA- certified for hazardous locations **Type 4 Enclosure**

Ex ia IIC T6
Class I, Division 1, Groups A, B, C and D; Class II, Division 1, Groups E, F + G; Class III.



Installation shall be in accordance with the C.E.C. Part 1

Table 1: Intrinsic Safety Parameters

	Fieldbus				Limit-switches inductive	Forced venting-function	Binary- input		Serial-Interface	
	Foundation		Profibus				1	2	Active	Passive
Circuit No.	1		1		2	3	4	5	6	6
Terminal No.	11 / 12 (IEC 1148-2)		11 / 12 (IEC 1148-2)		41 / 42	81 / 82	87 / 87	85 / 86	plug	
Groups	IIC	IIB	IIC	IIB	#/#	#/#	#/#	#/#	#/#	#/#
V_{max} [V]	24		17,5		16	28 30	28 30	###	###	16
U_0 or V_{0C}	##							5,88V	8,61V	###
I_{max} [mA]	360	380	380		25 52	115 100	115 100	###	###	25
I_0 or I_{SC}	##							1mA	55mA	###
P_{max} [W]	1,04	2,58	5,32		64mW 169mW	##	##	7,2 mW	250 mW	64 mW
C_i [nF]	2				60	5,3	0	###	###	0
C_0 or Ca	##							2µF	0,61µF	###
L_i [µH]	10				100	0	0	###	###	0
L_0 or La	##							10mH	9mH	###

Binary- input 1: For connection of an active signal circuit

Binary- input 2: For connection of an passive contact circuit directly on the control valve, e.g. passive pressure switch for leakage monitoring

Notes:

1. Entity parameters must meet the following requirements:

   $V_{0C} \leq V_{max}$, $I_{SC} \leq I_{max}$, $P_0 \leq P_{max}$
   C_0 or $C_a \geq C_i + C_{cable}$ and L_0 or $L_a \geq L_i + L_{cable}$

2. Install in accordance with the Canadian Electrical Code Part I

3. Cable entry M 20 x1,5 or metal conduit acc. to dwg. No. 1050-0540

* Circuit 3 can be connected to a CSA Certified zener barrier that is rated as follows:
- Supply channel (connect to Terminal 81): Voc ≤ 28V max. and Rmin ≥ 245 Ω
- Return channel (connect to Terminal 82): ≤ 28V max with diodes Return (zero current)

** Circuit 4 can be connected to a CSA Certified zener barrier that is rated as follows:
- Supply channel (connect to Terminal 87): Voc ≤ 30V and Rmin ≥ 300 Ω
- Return channel (connect to Terminal 88): Voc ≤ 30V max with diodes Return (zero current)

Table 2: CSA – certified barrier parameters of circuit 4

Barrier	Supply barrier		Evaluation barrier	
	V_{0C}	R_{min}	V_{0C}	R_{min}
circuit 3	≤28V	≥245Ω	≤28V	Diode
circuit 4	≤30V	≥300Ω	≤30V	Diode

The correlation between temperature classification and permissible ambient temperature ranges is shown in the table 3 below:

Table 3:

Temperature class	Permissble ambient temperature range
T6	+60°C
T5	-40°C ≤ T_a ≤+70°C
T4	+80°C

Table 4: Energy-Limited (Non- Incendive) Parameters

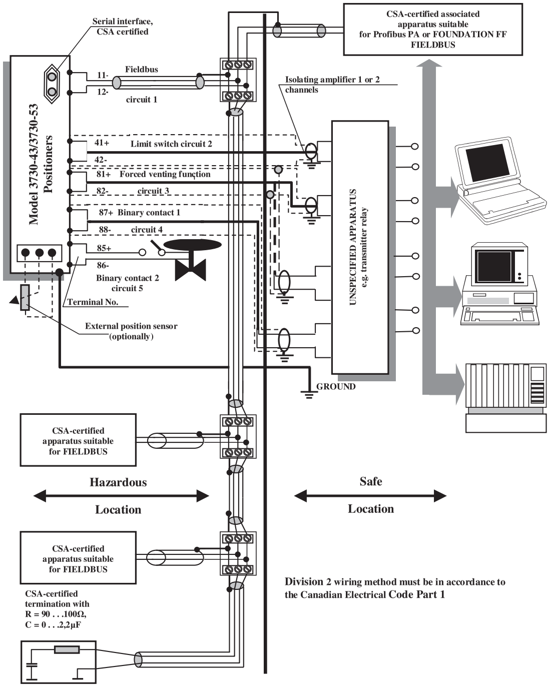
	Foundation Fieldbus or Profibus PA (Non incendive Equipment)								Limit-switches (inductive)	Forced venting function	Binary-Input 1
Terminal	11 / 12 (IEC 1148-2)								41 / 42	81 / 82	87 / 88
Groups	A, B and IIC				C, D and IIB				#/#	#/#	#/#
U_i or V_{max} [VDC]	20V	24V	30V	32V	20V	24V	30V	32V	20V	28V 30V 32V	28V 30V 32V
I_i or I_{max} [mA]	464	261	152	130	1,117 A	650	379	324	25mA 52mA	115mA 100mA 90mA	115mA 100mA 90mA
P_i or P_{max} [W]	2,32	1,56	1,14	1,14	5,88	3,89	3,85	2,77	64mW 169mW	##	##
C_i	2nF								30	5,3	0
L_i	10µH								100	0	0

Maximum values for serial-interface and binary input 2 see table 1

CSA certified for hazardous locations:

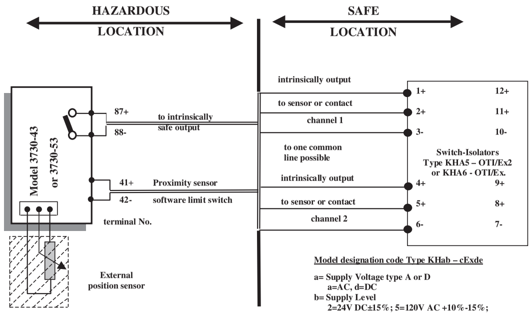
Ex nA II T6 / Ex nL IIC T6
Class I, Div. 2; Groups A, B, C, D; Class II, Div. 2 Groups E, F + G; Class III

Type 4 Enclosure



Division 2 wiring method must be in accordance to the Canadian Electrical Code Part 1

Installation drawing Control Relay KHA5-OTI/Ex2, KHA6-OTI/Ex1 or KHA6-OTI/Ex2 with Model SJ-b-N Proximity Sensors



Model designation code Type KHab – cExde

a= Supply Voltage type A or D
a=AC, d=DC
b= Supply Level
2=24V DC±15%; 5=120V AC +10%-15%;
6=230V AC+10%-15%;
c= Output type RTA/; RW1/; SS1/; SS2/; RS1/; SR/; ST-or SOT
d= Number of channels 1 or 2
e= Power rail designation, P, 2S.P or GS.P (includes Model KHD2-EB-PB Power Feed Module) or Blank

The total series inductance and shunt capacitance of shield wiring shall be restricted to the following maximum values

maximum capacitance of each inductive sensor 30nF
maximum inductance of each inductive sensor 100µH

System parameters

Control Relay Terminal No.	Groups	L [mH]	C [µF]	V_{0C} [V]	I_{SC} [mA]	V_{max} [V]	R_{min} [Ω]
1-3; 2-3 4-6; 5-6	A + B	192	2,66	10,5	13	10,5	811
	C + E	671	7,9				
	D, F, G	1000	21,3				

Division 2 wiring method shall be in accordance to the Canadian Electrical Code Part 1.

Installation Manual for apparatus approved by FM for use in hazardous locations.
Communication is optionally either according to the **FOUNDATION**^{TM} Fieldbus Specification or according to **PROFIBUS PA** in compliance **FISCO-Concept**

The **FISCO Concept** allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criteria for interconnection is that the voltage (**V_{max}/Ui**) the current (**I_{max}/Ii**) and the power (**Pi**) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (**V_{OC}/U_0**) the current (**I_{SC}/I_0**) and the power (**P_0**) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (**Ci**) and inductance (**Li**) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to **5 nF** and **10 µH** respectively.
In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system The allowed voltage (**V_{OC} /Uo**) of the associated apparatus is limited to the range of **14V DC**. to **24V DC**. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50mA for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices need to have the parameters in the following range:

Loop resistance R‘:	15 ... 150 Ohm/km
Inductance per unit length L‘:	0,4 ... 1 mH/km
Capacitance per unit length C‘:	80 ... 200 nF/km

C‘ = C‘ line/line + 0,5 C‘ line/screen, if both lines are floating or, C‘ = C‘ line/line + C’line/screen, if the screen is connected to one line

Length of spur cable:	≤ 30 m
Length of trunk cable:	≤ 1 km

At each end of the trunk cable an approved infallible line termination with the following parameters is suitable:

R = 90 ... 100 Ohm   C = 0 ... 2,2 µF

One of the allowed terminations might already be integrated in the associated apparatus.

The number of passive devices connected to the bus segment is not limited due to I.S. reasons. If the above rules are respected, the inductance and capacitance of the cable will not impair the intrinsic safety of the installation.

Notes:

1. Approved associated apparatus must be installed in accordance with manufacturer instructions
2. Approved associated apparatus must meet the following requirements:
   Uo or Voc ≤ Ui or Vmax, Io or Isc ≤ Ii or Imax, Po ≤ Pi or Pmax
3. The maximum non-hazardous area voltage must not exceed 250 V.
4. The installation must be in accordance with the National Electrical Code ANSI/NFPA 70 and
   ANSI/ISA RP 12.06.01
5. Each set of wires must be provided with grounded shield. The shield must extend as close to the terminal(s) as possible and it must be grounded shield at I. S. Barrier ground.
6. Caution: Use only supply wires suitable for 5 °C above surrounding.
7. Warning: Substitution of components may impair intrinsic safety. PE = I. S. Ground
8. The polarity for connecting 11 and 12 is of no importance due to an internal rectifier.
9. FISCO concept applies to fieldbus / circuit only.
10. Entity parameters apply to circuit 2, 3 and 4 and further required to meet the following conditions:
    Co ≥ Ci + Ccable; Lo ≥ Li + Lcable

Intrinsically safe if installed as specified in manufacturer’s installation manual.

FM- approved for hazardous locations

Class I, Zone 0 AEx ia IIC T6:
Class I, II, III Div. 1, Groups A, B, C, D, E, F + G.   **Field enclosure NEMA 4X**

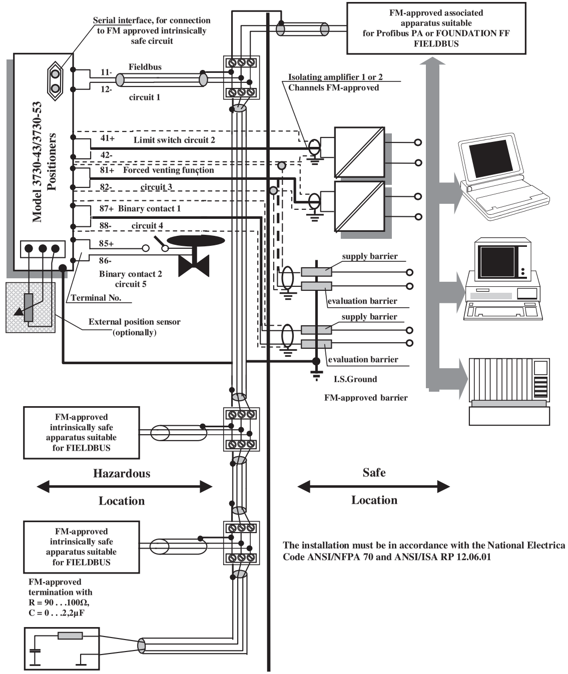


Table 1: Maximum values

	Fieldbus			Limit-switches inductive	Forced venting-function	Binary- input		Serial-Interface	
	Foundation		Profibus			1	2	active	passive
Circuit No.	1		1	2	3	4	5	6	6
Terminal No.	11 / 12		11 / 12	41 / 42	81 / 82	87 / 88	85 / 86	plug	
Groups	A, B IIC	C, D IIB	A, B, C, D IIC / IIB	#/#	#/#	#/#	#/#	#/#	#/#
U_i or V_{max} [V]	24		17,5	16	28	30	V_{OC} 5,88	V_{OC} 8,61	V_{max} 16
I_i or I_{max} [mA]	360	380	380	25	115	100	I_{SC} 1	I_{SC} 55	I_{max} 25
P_i or P_{max} [W]	1,04	2,58	5,32	64 mW	##	##	7,2 mW	250 mW	64 mW
C_i [nF]	5			60	5,3	0	2µF	0,61µF	0
L_i [µH]	10			100	0	0	10mH	9mH	0

Binary- input 1: For connection of an active signal circuit

Binary- input 2: For connection of an passive contact circuit directly on the control valve, e.g. passive pressure switch for leakage monitoring

Notes:

1. Entity parameters must meet the following requirements:

   $U_0 \leq U_i$ **or** V_{max} **,** $I_0 \leq I_i$ **or** I_{max}**,** $P_0 \leq P_i$ **or** P_{max}
   C_0 **or** $C_a \geq C_i + C_{cable}$ and L_0 **or** $L_a \geq L_i + L_{cable}$

2. The installation must be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01

3. Cable entry M 20 x1,5 or metal conduit acc. to dwg. No. 1050-0540

Table 2: FM – approved barrier parameters of circuit 4

Barrier	Supply barrier				Evaluation barrier	
	V_{OC}	R_{min}	I_{OC}	P_{max}	V_{OC}	R_{min}
circuit 3	≤28V	≥245Ω	≤115mA	##	≤28V	Diode
circuit 4	≤30V	≥300Ω	≤100mA	##	≤30V	Diode

The correlation between temperature classification and permissible ambient temperature ranges is shown in the table 3 below:

Table 3:

Temperature class	Permissble ambient temperature range
T6	+60°C
T5	-40°C ≤ T_a ≤+70°C
T4	+80°C

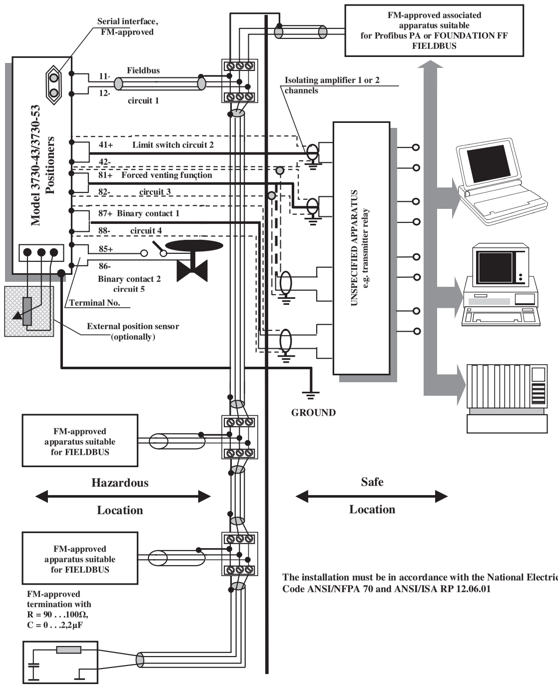
Table 4:

	Foundation Fieldbus or Profibus PA (Non incendive Field wiring)								Limit-switches (inductive)	Forced venting function	Binary-Input 1
Terminal	11 / 12								41 / 42	81 / 82	87 / 88
Groups	A, B and IIC				C, D and IIB				#/#	#/#	#/#
U_i or V_{max} [VDC]	20V	24V	30V	32V	20V	24V	30V	32V	20V	30V	30V
I_i or I_{max} [mA]	464	261	152	130	1,117 A	650	379	324	25mA	100mA	100mA
P_i or P_{max} [W]	2,32	1,56	1,14	1,14	5,88	3,89	3,85	2,77	64mW	##	##
C_i	5nF								60	5,3	0
L_i	10µH								100	0	0

Maximum values for serial-interface and binary input 2 see table 1

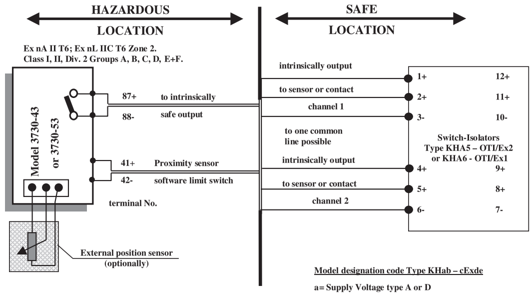
FM approved for hazardous locations:
Ex nA II T6; Ex nL IIC T6 Zone 2.
Class I, II, Div. 2 Groups A, B, C, D, E+F.

Field enclosure NEMA 4X



The installation must be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01

Installation drawing Control Relay KHA5-OTI/Ex2, KHA6-OTI/Ex1 or KHA6-OTI/Ex2 with Model SJ-b-N Proximity Sensor



maximum capacitance of each inductive sensor 30nF
maximum inductance of each inductive sensor 100µH

<u>Model designation code Type KHab – cExde</u>

a= Supply Voltage type A or D
a=AC, d=DC
b= Supply Level
2=24V DC±15%; 5=120V AC +10%-15%;
6=230V AC+10%-15%;
c= Output type RTA/; RW1/; SS1/; SS2/; RS1/; SR/; ST-or SOT
d= Number of channels 1 or 2
e= Power rail designation, P, 2S.P or GS.P (includes Model KHD2-EB-PB Power Feed Module) or Blank

Each pair of I.S. wires must be protected by a shield that is grounded at the I.S. Ground. The shield must be extend as close to the terminals as possible installation shall be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01.

The total series inductance and shunt capacitance of shield wiring shall be restricted to the following maximum values

System parameters

Control Relay Terminal No.	Groups	L [mH]	C [µF]	V_{0C} [V]	I_{SC} [mA]	V_{max} [V]	R_{min} [Ω]
1-3; 2-3 4-6; 5-6	A + B	192	2,66	↑	↑	10,5 ↑	811 ↑
	C + E	671	7,9	10,5	13		
	D, F, G	1000	21,3	↓	↓	↓	↓

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